

HORTICULTURAL ABSTRACTS.

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Abstracts. Initialled abstracts in the present number are by T. N. Hoblyn and M. C. Vyvyan, the remainder being by the Bureau Staff.

INDEX OF CONTENTS.

HORTICULTURE—MISCELLANEOUS	Nos. 101-105
TREE FRUITS, DECIDUOUS	106-145
Selection	106-108
Propagation	109-114
Rootstocks	115-117
Pollination	118-124
Growth, Nutrition, etc.	125-130
Cultural Practices	131-136
Plant Protection	137-145
SMALL FRUITS, VINES, NUTS	146-155
CITRUS AND SUB-TROPICAL FRUITS	156-171
TROPICAL CROPS	172-198
STORAGE	199-207
NOTES ON REPORTS AND BOOKS	208-210

Horticultural Abstracts

Vol. II

June, 1932

No. 2

HORTICULTURE—MISCELLANEOUS.

101. POTTER, G. F. 634.11 : 581.084.2 : 519
Significance of the Probable Error as applied to field experiments with apple trees.

Proc. Amer. Soc. Hort. Sci., 1930, 27 : 534-5, bibl. 1.

The author points out some of the reasons why the testing of a difference between two sets of data by means of their probable errors has led to absurd results. A standard deviation is only a sound measure of variability when it includes all sources of variability which enter into the experiment. Those include inherent differences in the trees themselves, differences in soil, culture and weather conditions, and only when all these factors are allowed for in the planning and conduct of the experiment can an estimate of error of any value be obtained. Thus, similar plots should be scattered at random over the entire experimental field in order to measure soil differences. A standard deviation based merely upon annual fluctuation in yield of the same plot would not include variations either in soil or in the individual trees themselves, and could not indicate whether the difference in yield between two such plots was due to the differential treatment in the experiment.

T.N.H.

102. FORSTER, H. C., AND VASEY, A. J.
The development of accuracy in agricultural experiments. A review of certain types of plot technique, and their application to cereal trials in Victoria.
J. Agr. Victoria (Aust.), 1932, 30 : 35-52, bibl. 26.

A feature of agricultural literature in recent years has been the growing interest in the art of field experimentation, as a distinct and vital part of research in field crops. No longer can the research worker use "any old method" of laying out his plots and assure himself that his results will be accepted. He must, on the contrary, make himself acquainted with modern methods of plot lay out and, if he is out of touch with experts in this branch, familiarize himself with the more simple statistical methods of analysing his results. Here is another admirable summary of the progress which has been made in this direction during the past decade. The authors have examined the various methods and here illustrate their conclusions by actual examples of experiments done on the State Research Farm at Werribee. A useful bibliography is added, and in an appendix several examples are worked out in detail.

T.N.H.

103. VAIDYANATHAN, M.

The statistical basis of the total production of a crop.*Agriculture and Livestock in India, 1932, 2 : 6-12, bibl. 2.*

The importance of accurate crop forecasting in an agricultural country such as India is stressed, and an account is given of the methods by which such forecasts are arrived at and their accuracy tested. Three factors are taken into account in framing an estimate of outturn, viz., the acreage, the condition factor and the standard normal outturn per acre. Of these, the condition or seasonal factor, which is based on the "anna estimate" of the local reporting officer, is perhaps the most liable to error, and the author points out that "a statistical intuition combined with systematic methods of examination is necessary . . . before the data of the reporting agency are finally adopted." Sampling methods which can be used to check the estimate of the standard normal outturn are described; and finally suggestions are made whereby trade returns and meteorological records may be utilized further to improve the forecast. T.N.H.

104. ARTHUR, J. M.

634.11-1.56

Red pigment production in apples by means of artificial light sources.*Contrib. Boyce Thompson Inst., 1932, 4 : 1-18, bibl. 13.*

The author does not pretend that any process tried by him is yet commercial. His work with various glass, temperatures and exposures leads him to conclusions, among which are the following: Ultra-violet, violet and blue regions of sunlight were most valuable in producing colour on picked apples. The carbon arc, CX Mazda and S-1 lamps all proved effective in colouring apples but all produced severe injuries due mainly to excessive energy in the infra-red region. The best light source for the purpose was found to be the 50 inch mercury vapour arc in Uviol glass, set at a distance of about 16 inches from the fruit and used in conjunction with a Corex D. filter. The best air temperature was 15° C. The rate of pigment production when exposed was greatest on fruit picked green on August 25th. This was well coloured after forty hours' exposure. The rate later fell off. The green peel removed coloured at the same rate, unless previously heated or otherwise treated so as to injure the cells. Production of colour was found to be a function of the living cells. This would probably account for failure to colour after a period of storage. [Rogers actually found that colouring, as compared on October 15th and November 9th, increased considerably after picking. East Malling Ann. Rept. for 1925, II. Rootstock effect on colour and size of apples.—ED.] Using various filters and the mercury lamp as a source the region producing the pigment most effectively was found to be the short ultra-violet from wave lengths 312 to at least 290 m μ and the visible region from wave length 600 m μ to the beginning of the ultra-violet.

105. CROWTHER, E. M.

631.4+631.8

Soils and fertilizers.*Repr. Reports of the Progress of Applied Chemistry, 1931, 16 : 479-515, bibl. 119.*

We have here in tabloid form a review of the most important work published on soils and fertilizers from the latter part of 1929 to the middle of 1931. It is not a mere list of names, but intelligible, useful and readable notes varying from a few lines to a page are given on each publication, which are considered under the following headings: (1) *Soils*—colloidal clay and soil formation; determination of soil reaction and replaceable bases; effect of fertilizers on soil reaction and exchangeable bases; mechanical analysis; the physical properties of soils; soil organic matter; available plant nutrients; the *Aspergillus* method for available potassium. (2) *Fertilizers*—the newest fertilizers; nitrogenous fertilizers; ammoniated superphosphate; basic slag and other phosphatic fertilizers; the application of fertilizers; the production and use of organic manures; the composition of pasture; changes in soil composition in long continued manurial experiments; the design of field experiments; analysis of soils, fertilizers and crops.

TREE FRUITS, DECIDUOUS.

Selection.

106. PASHKEVICH, W. W. 634.1/3 (47 Volhynia)
The varieties of fruit trees of Volhynia. [Russian-short English summary.]
Bull. Appl. Botany, Genetics and Plant Breeding, 43rd Supplement, 1930,
 pp. 216.

Fruit growing in this district has been largely influenced by the proximity of other European countries. The varieties of fruits to be found in the orchards, though of greater or less quality according to the degree of cultivation, do not differ much throughout the province. At the end of the bulletin a key to the apple and pear varieties is given.

107. PEARL, R. T. 634.11-1.521.3-1.547.4
The inflorescences of apple trees. Their use in the identification of varieties.*
J. Pom. Hort. Sci., 1932, 10 : 19-26, bibl. 15.

It will be no fault of the author if apple varieties remain unidentified. After showing in the *Journal of the South-Eastern Agricultural College*, No. 27, of 1930, how to identify some eight varieties by the character of the winter shoots, he here gives part of the results of his five year observations on the inflorescences of some sixty different varieties, a second paper actually being in the press. The value of such methods of identification is clearly and concisely set out by the author. Although in systematic records varieties have mainly been described by their fruit characters, the flower of the apple offers a somewhat easier and more certain means of identification in the field than any other part of the tree. The number of organs and range of form in the inflorescence is much less limited than is the case with foliage and branch characters, while inflorescence characters seem to be more constant than other characters under varying external conditions. He warns those intending to try his methods that the earliest and latest inflorescences should be disregarded as tending to abnormality, as also those from terminal buds or leaders, stout brindilles or positions likely to be associated with vigorous growth. He finds the following characters most consistently useful in identification from inflorescences:—*Inflorescence*—season of flowering, arrangement of flowers, length and stoutness of pedicels. *Flower bud and flower*—colour of flower bud, flower pose, texture of petals, pose of sepals, shape and margin of petals, pose of stamens, relative length of styles to stamens, length of style column, pubescence of styles and style column. *Young spur leaves*—shape, colour, shininess, upper surface, leaf-pose. He tabulates the inflorescence characters of ten popular commercial varieties, stating every feature and italicizing those by which alone in certain cases particular varieties can be identified. He states reassuringly that the adequacy of the descriptions given has been tested through their successful utilization by comparatively inexperienced students.

108. GIERSBACH, JOHANNA, AND CROCKER, W. 634.22 : 581.14
Germination and storage of wild plum seeds.
Contrib. Boyce Thompson Inst., 1932, 4 : 39-51, bibl. 10.

The authors found that the seeds of Wild Plum (*Prunus americana*) need a period of low temperature stratification or a period in a low temperature germinator for after-ripening preparatory to germination. Of the three low constant temperatures tried 5° C. was best and was closely followed by 1° C., 10° C. being much less effective. Sterilizing the seeds with Uspulun was not an advantage. Temporary artificial drying reduced germination. Seeds stored in a laboratory cupboard improved in germination up to 26-30 months, and retained more than half their vitality up to 46 months. To get the best seedlings under similar conditions to that obtaining at Yonkers it would appear advisable to stratify the seeds at about 5° C. for five months just previous to early spring planting in cold frames or sheltered beds.

* See also H.A., 1931, 1:1:60 and 1:3:224.

Propagation.

109. CARRANTE, V.

634.1/3 : 575.24

La selezione gemmaria nell' ortofrutticoltura. (Bud selection in horticulture.)

L'Italia Agricola, 1932, 69 : 351-70, bibl. 29.

The writer discusses the possibilities offered by bud selection, the methods of its application and the results already achieved, especially in the citrus groves of the U.S.A., and, after giving examples of the observed incidence of bud variation in Italian orchards, proceeds to detail the great advantages which, in his opinion, would follow the adoption of bud selection by Italian fruit growers. He also discusses the various theories propounded to explain bud variation. Published observations on bud mutations in Italy have been few, but these are in accordance with observations in other countries. In citrus orchards the following have been noted: trees of the "Ovali" (oval) orange bearing round fruits, of "Tarocco di muso" bearing fruits without a "muso" or nose, of the "Sanguigno" orange with oval instead of round fruits, of "Sanguignello" with oval and round instead of slightly oval fruits, of a lemon tree producing both seeded and seedless fruits. The finder of one such bud mutation in a grove at Agro di Erchie isolated and propagated this mutation and finally successfully worked over his entire orchard to the seedless type. In almonds a case is noted of a mutation of the "Fragiulia" almond at Agro di Bisceglie. The almonds on one branch of a tree were found by comparison with the others to be larger, single seeded, depressed and smooth. Trial of the bud progeny showed it to be a true bud mutation, and this superior strain was accordingly isolated and propagated. The above are all observed and proved bud mutations. The writer considers that similar observations could also establish the presence of bud variation among olives, vines, nuts and other fruit plants in Italy. He cites the case of the "Sorrento" walnut, which shows greatly varying characters of shape, texture and other features. The fact that it is no longer a standardized product has already adversely affected the foreign market. Some of the variance may be due to environmental conditions, but in many cases it will be due to bud variation, when standardization could and should be carried out by bud selection. Again, the viticultural associations have done wonders in selecting and standardizing American rootstock material, but have neglected an equally necessary selection of scion bud wood. The famous Baresana table grape shows two distinct types, the first possessing a close, round-berried cluster, the second a loose cluster with oval berries, which is to be preferred for long transport. The occurrence of one type is sometimes common to the whole of one plant, sometimes only to certain branches, whilst in some cases the phenomenon persists from year to year, in others it does not. Trial of bud progeny would show which occurrences are due to environment and which to bud mutation. The latter could then, if desired, be perpetuated. The writer stresses throughout the necessity for selection of both parts of the tree, the rootstock and the scion. "Who would be so rash," he says, "as to affirm the genetic identity of two rootstocks, merely because they are both taken from sour orange, or sour lemon, or wild olive? Actually each rootstock in such a case is a separate entity, possessing its own particular characters and capable of reacting differently on the scion worked upon it. Then obviously it is only by rigid selection of both bud and stock equally that we can fix in a tree those characteristics, which are desirable from an agricultural and commercial standpoint."

110. SHAMEL, A. D., AND OTHERS.

634.25 : 575.24

Bud variation in peaches.

United States Dept. Agr. circ. 212, 1932, pp. 21, bibl. 1.

A report of scientific study of bud variation in the trees of several important canning varieties of peach. Work was begun in 1925 and is continuing. Careful individual tree records are taken and a systematic effort is being made to determine varietal characteristics by means of estimate-yield records, together with notes and illustrations of outstanding foliage and fruit characters. Seventy marked limb and entire tree variations have been found and it has been demonstrated that striking bud variations occur more frequently than has hitherto been considered probable. The variations are being subjected to comparative progeny tests with

the normal growth. Some of these variations may be of commercial interest. Careful selection of budwood in peach tree propagation is advisable, and the trees selected to supply the propagating material should be those whose records show a satisfactory fruit yield both as to quantity and quality. Photographs illustrate the differences between the mutations and the normal fruits and growth.

111. CHADWICK, L. C. 631.535.4

Factors influencing the rooting of deciduous hardwood cuttings.

Proc. Amer. Soc. Hort. Sci., 1931, 28 : 455-9, bibl. 9.

An account of the trial in Ohio of the following factors on the subsequent rooting of hardwood cuttings of *Cornus alba*, *Ligustrum vulgare*, *Lonicera Morrowi* :—(1) time of taking, (2) storage media, (3) position of basal cut, (4) storage temperature. Late winter and early spring were found preferable in all cases to late autumn and early winter. As between sand and a mixture of sand and peat moss there was little to choose. Peat alone was not so good except when the storage period was very short. Other conditions for rooting being satisfactory the position of the basal cut would not seem to warrant special attention. Storing the cuttings for the first two weeks at 60° F. and then at 40° F. gave the best results for cuttings taken in the fall. Cuttings taken in the fall and in the spring and lined out directly gave better results than were expected, but there was considerable variation among the different plants. [Under English conditions late autumn, i.e. September and October, are the most suitable months for hardwood cuttings. Late winter and early spring are not satisfactory. Storage of cuttings is not necessary here.—ED.]

112. ESPER, H. C., AND ROOF, L. R. 631.535.4

Studies in propagation of softwood cuttings of ornamentals based on temperature, defoliation and kind of media.

Proc. Amer. Soc. Hort. Sci., 1931, 28 : 452-4.

A temperature of 70° F. was found to be more suitable for rooting most species of ornamentals tried (a list is given) than one of 60° F. The experiments indicate that in making cuttings of many varieties of plants root development and growth is in proportion to the leaf surface exposed. With most plants having medium-sized leaves, where root development is promoted, defoliation would appear inadvisable, at least on the scale commonly practised. Results obtained indicate that sand is not the best propagating medium for all plants. The combinations of peat and slag, and peat and sand are particularly valuable.

113. TUKEY, H. B., AND BRASE, K. 634.1/2-1.535.4

Experiences in rooting soft and hardwood cuttings of hardy fruits.

Proc. Amer. Soc. Hort. Sci., 1931, 28 : 460-4, bibl. 1.

Softwood cuttings. Efforts to root 1,080 such cuttings of two varieties of apple (*Pyrus Malus*) struck at three dates in mid-summer, in three different rooting-media and in two locations were entirely unsuccessful. One cutting rooted of 1,080 cherry cuttings (*Prunus Avium*), and one of 720 pear cuttings (*Pyrus communis*). No *Prunus domestica* cuttings rooted, but a few *Prunus cerasifera* cuttings rooted and became strong plants.

Hardwood cuttings of varieties. No success was achieved with hardwood cuttings of 1 year and 1 year + portions of 2 and 3 year wood of Northern Spy, Rome, Ben Davis, Whitney and McIntosh and only one out of twenty cases succeeded with *Malus baccata*.

Hardwood cuttings from layered apple stocks. Considerable success, i.e. 56.5% and 57.5% respectively, was got with hardwood cuttings carrying a portion of older wood taken from the unrooted shoots of layered stocks of Malling I and Malling IX, though only 7.5% successes were got with Malling XIII and none with Malling XII. In 1931 49% of similar Malling I cuttings rooted, 22.5% of IX and 23% of French Doucin (No. II ?), though no rooting occurred with

cuttings of XIII. But contrary to the experience of 1930, cuttings from the 1 year wood rooted to the extent of 17.8% in I, 5.3% in III and 51.2% in Doucin, though those of IX again failed to root. The practical significance of these results is that a supplemental rooting of the layered stocks is so obtained. The authors suggest that "If 46-67% of the shoots from mounded and trench layered plants of these types can be rooted [as described by the same authors in the Proceedings of the same Society for 1930, vol. 27.—Ed.], and if then the unrooted shoots from these mother plants can be rooted as hardwood cuttings to the degree here shown, the total percentage of rooted shoots brings the practice within the range of commercial possibility." *Hardwood quince cuttings.* Angers quince cuttings taken from layered plants rooted as follows in 1931: French from 1 year wood 7.6%, with heel of 2 year wood 54.1%, English from 1 year wood 5.4%, Quince A ditto 15.0%, Quince B ditto 0%, Quince C, heel of 2 year wood only tried, 80%. Only 1 year wood cuttings were used of English and of A and B Quinces and no 1 year wood cuttings were used of Quince C.

114. HITCHCOCK, A. E., AND ZIMMERMAN, P. W. 631.535.1
Relation of rooting response to age of tissue at the base of greenwood cuttings.
Contrib. Boyce Thompson Inst., 1932, 4: 85-98.

The rooting response of greenwood material was compared in a number of shrubs for four types of cuttings:—(1) Cuttings possessing a mallet shaped piece of last season's wood; (2) those possessing just a heel of that wood; (3) cuttings made at the base of the current season's growth; (4) cuttings made at $\frac{1}{4}$ – $\frac{3}{4}$ inches above the base of the current season's growth. Although no one of the four types of cuttings produced the best rooting for all species, the rooting of type 1 was generally poor and that of type 3 generally good. The method employed and commended as not necessitating such care in watering and ventilation as is needed by the standard commercial practice in frames was as follows:—The cuttings were set deeply in sand or a mixture of peat moss and sand so that only a few leaves were exposed. Some or all leaves were left on the buried part. Water was added to settle the sand around the cuttings. During this the tops of the cuttings were pressed down with the palm of the hand, so that most of the exposed leaves lay close to or nearly flat on the surface of the medium. A single layer of cheese-cloth was laid on the top, watering being subsequently done over the cloth. During cloudy periods or in cool weather the cloth was removed, but it usually remained on the cuttings over night during spring and summer. The cloth was sprayed several times a day during hot weather. No lights were used either on frames outside or in the greenhouse.

Rootstocks.

115. GLEISBERG, W. 634.2-1.541.11
 Die Steinobstunterlagen unter besonderer Berücksichtigung der englischen Selektionsarbeit. (Rootstocks for stone fruits with special reference to English work on selection.)
Züchter, 1932, 4: 81-97, bibl. 14.

A résumé of stone fruit rootstock selection work on the same lines as that given by the author in 1931 on pome fruit rootstocks.* The English results to date are detailed and a plea is made for similar attention to this all important phase of propagation in Germany, especially in those parts where stone fruits are widely cultivated. He takes to task recent writers in Germany who advocate working on seedling stock, although they themselves admit its great variability.

* *Züchter, 1931, 3: 305-21 and H.A., 1931, 1: 4: 335.*

116. GRUBB, N. H., AND OTHERS.

634.23-1.541.11-1.542

Some aspects of Morello Cherry culture.*Kent Cherry and Soft Fruit Show Catalogue, 1931, reprinted in East Malling Res. Sta. Ann. Rept. for 1931, 1932, A.15, pp. 57-60.*

Stock trials with Morellos began in 1922, the stocks being a number of selected Mazzards, two selected Mahalebs and two selected acid cherry seedlings all propagated by layering for the sake of uniformity. Mahalebs tried in this country do not root readily from layers. The two acid seedling stocks are found to dwarf the tree and reduce the cropping excessively. The Mahalebs have given stronger trees in the nursery than any of the Mazzards. On one of them the Morello trees were still (seven years after planting) bigger than any on Mazzard, but the latter were rapidly catching up in size. Moreover three out of eighteen trees on Mahaleb developed an obscure "disease" resembling but not identical with *Stereum purpureum* and have been removed. No trees on Mazzard have behaved similarly. There are also indications that trees on Mahaleb are more susceptible to brown rot than any of those on Mazzard. The authors conclude that Mahaleb stocks might possibly prove satisfactory for short-lived "filler" trees, but that Mazzards would probably be better for longer lived trees. Since Morellos bear their fruit mainly on shoots of the previous year, certain suggestions are made for pruning. For at least two years after planting a moderate tipping of leaders should be carried out. Afterwards a moderate thinning out of the head should take place, inward and crossing shoots being cut back to wood buds, which are often found near the base. Morello trees left unpruned tend to become so dense that nearly all the fruiting wood is on the outside, the centre consisting entirely of bare wood. Even a moderate thinning will prevent this. The most serious disease is Brown Rot (*Sclerotinia* [*Monilia*] *cinerea*) which chiefly attacks the blossom. It is essential to cut out all dead or dying twigs directly the blossom on such twigs shows a sudden wilting and further to remove any dead twigs missed during the previous summer before the blossom opens in spring. Bacterial canker also sometimes attacks Morellos and should be cut out when seen.

117. ROBERTS, R. H.

634.11-1.541.11/12

Notes upon stock and scion relations in 1931.*Proc. Amer. Soc. Hort. Sci., 1931, 28 : 470-2, bibl. 2.*

The author reports that scions of the following varieties were got from Long Ashton, England, and root grafted in March, 1931, using a 3-bud scion and approximately a 5-inch seedling root: Bramley, Beauty of Bath, Cox's Orange, Grenadier, Grieve, Lane's Prince Albert, Newton Wonder, Tyler's Kernel and Worcester Pearmain. On digging these in November it was found that all except Tyler's Kernel had almost exactly the same type of root, having many horizontally growing roots along the stock with a tendency to cluster near the soil surface. In Tyler's Kernel the roots were of the same type but were more evenly distributed along the stock. The amount of roots in relation to the size of the whips varied considerably, being greatest under Lane's and Grieve and least under Cox, Beauty and Bramley. In the same planting the root types of the following varieties were very different from each other and from the English kinds: Yellow Siberian, Fameuse, Starking, York and Whitney. He concludes therefore that English varieties do show scion influence, but that this was so similar in those used as to be hardly observable except quantitatively. He considers that root grafted trees are repeatedly shown to have a uniform root type within a variety and stem grafted or budded trees to have variable root types presumably much like the ungrafted seedling. He notes that roots exposed to sunlight take on the external appearance of stems. He has observed moreover the behaviour of some scions set on roots 8-9 inches long, which were then planted with the union above ground. From the limited number (not stated) of grafts which survived a difficult growing season in 1931, it appears that these grafts do not show the degree of scion influence which results from normal planting of the union below ground level. If further trials verify this observation, the writer is of the opinion that the way is opened to the source of stock influence and absence of scion influence on stem grafts, and this will probably lie in the phloem region.

Pollination.

118. BURRELL, A. B., AND KING, G. E. 634.1/2 : 581.162.3

A device to facilitate pollen distribution by bees.*Proc. Amer. Soc. Hort. Sci.*, 1931, 28 : 85-6.

The "bee pollen-coater" is a modification of what is known to beekeepers as a winter hive entrance block. This is a diagonal horizontal tunnel about 6 inches long, 3 inches wide and $\frac{1}{2}$ inch high, and is attached to the front of the hive. For transformation the roof of the tunnel is removed. Two wooden strips each $\frac{1}{2}$ inch high are nailed across the floor of the tunnel forming an enclosure to contain the pollen. A glass plate is substituted for the original roof of the tunnel, so that one may observe the bees and determine readily when the pollen supply needs replenishment. A piece of wood is laid over this plate when it is wished to prevent excessive heating. The device is illustrated.

119. KRUMMEL, H. 634.23 : 581.162.3

Weitere Untersuchungen über die Befruchtungsverhältnisse bei Kirschen.

(Further studies of cherry pollination.)*Gartenbauwissenschaft*, 1932, 6 : 262-302, bibl. 53.

Among the results of recent experiments in Germany the following may be noted : Self-fertility generally absent in sweet cherries is more frequent in sour cherries. Where inter-sterility occurs in sweet cherries, its incidence is normally reciprocal, though Branscheidt cites two groups in each of which two sorts are inter-sterile with a third but not as between each other. The pollination of sour cherries by sweet is generally more successful than vice versa. Comparisons of crop percentages attained on free pollinated and other trees showed that the exact height of the ratio between blossom number and fully formed fruit is no measure for the value of the pollination, but that the relation between the blossom number and fruit number peculiar to particular kinds as also the cropping capacity of the tree in question must always be taken into consideration. The author's experiments were carried out at Diemitz and at Geisenheim.

120. KNOWLTON, H. E. 634.11 : 581.162.3

Pollination studies with some newer apple varieties.*Proc. Amer. Soc. Hort. Sci.*, 1931, 28 : 71-3, bibl. 1.

Results of one year's observations in West Virginia indicate that Northwestern is self-sterile and that Starking, Red Rome, Lowry, York, Jonathan and Delicious are good pollenizers. Rome was found to be practically self-sterile as the result of two years' experiments but to give a good set of fruit when pollinized by King David, Northwestern, Golden Delicious, Jonathan, Starking, and Lowry. York, which constitutes over 15% of the commercial orchards in the district, and is generally considered self-fertile enough for commercial planting, gave practically no set of fruit when experimentally selfed in 1931.

121. BURRELL, A. B., AND PARKER, R. G. 634.11 : 581.162.3

Pollination of the McIntosh apple in the Champlain Valley—Third progress report.*Proc. Amer. Soc. Hort. Sci.*, 1931, 28 : 78-84, bibl. 2.

Hand pollination of the same McIntosh branches for three successive years with Fameuse, Tolman, Delicious and Cortland yielded satisfactory results, while results in 1931 suggest that some promise as McIntosh pollenizers is offered by Early McIntosh, Milton, Kendall, Lobo and Macoun. In a solid McIntosh block hand pollination of the same unit branches for three successive years with different varieties resulted in doubling the yield. During a cool rainy blossoming period the effect of bouquets was found to be remarkably local, only the flowers on branches absolutely adjacent to the bouquet receiving anything like the full benefit.

122. LATIMER, L. P. 634.11 : 581.162.3
Further observations on factors affecting fruit setting of the McIntosh apple in New Hampshire.

Proc. Amer. Soc. Hort. Sci., 1931, **28** : 87-92, bibl. 1.

The author's data are taken from three McIntosh trees and two Cortland trees enclosed in cheese-cloth cages and pollinated as desired. They strengthen his previous opinion that more importance should be paid to the choice of pollenizing varieties, especially when the vigour of the orchard trees is low. On the most vigorous tree in the experiment there was little or no difference in set of fruit according to the particular pollenizer used of several different good pollenizers, whereas considerable difference was apparent in the case of the third, and least vigorous McIntosh tree. He finds that for the less vigorous tree, Delicious and apples of the Delicious type head the list of pollenizers. Other satisfactory pollenizers are Milton, Cortland, Lobo, Melba and Fameuse. Different pollens differed in their ability to cause seeds to develop in McIntosh, Delicious again heading the list, and bad pollenizers such as McIntosh itself, Gravenstein and Red Gravenstein being at the bottom. The author urges that greater attention should be paid to expressing fruit set on the basis of spurs rather than that of individual flowers, since the potential crop may more easily be gauged by following the former method. The high set indicated by noting the percentage of flowers setting fruit is misleading in cases where a large percentage of the spurs produce two or more fruits, since in this case some of the fruit would be thinned, leaving generally only one fruit to a spur at most.

123. OVERHOLSER, E. L., AND OVERLEY, F. L. 634.11 : 575.24 : 581.162.3
Pollination of certain apple bud sports in North Central Washington.

Proc. Amer. Soc. Hort. Sci., 1931, **28** : 74-7, bibl. 8.

This affords some guide to the pollination status of certain bud sports of recent introduction. The following bud sport varieties and their parents seemed to the writers to be satisfactory pollenizers for the *Delicious*, which is self-unfruitful:—Blackjon, King John, Red Rome, Jonathan and Rome. Red Stayman, Richared, Shotwell Delicious, Starking and Winesap seemed to be cross-unfruitful with Delicious. Golden Delicious gave different results at different times and places. *Winesap*, also self-unfruitful, was satisfactorily pollinated by Delicious, Richared, Starking, Golden Delicious, King John and Red Rome; unsuccessful was the pollen of Red Stayman and Stayman. *Richared* (N.B. the test trees were only seven years old), was self-unfruitful. It seemed to be adequately cross-fertilized by King David, McIntosh, Ortley, Rome and Winter Banana. Golden Delicious, King John and Red Rome were only partially satisfactory. Yellow Newtown pollen gave an excellent set in 1929, but not in 1930 and 1931. *Starking* was self-unfruitful, and was inter-unfruitful with Delicious and Shotwell Delicious. Varieties suggested by experimental results as satisfactory pollenizers for it are Blackjon, Golden Delicious and White Winter Pearmain.

124. CLAYPOOL, L. L., OVERLEY, F. L., AND OVERHOLSER, E. L. 634.23 : 581.162.3
Sweet cherry pollination in Washington for 1931.

Proc. Amer. Soc. Hort. Sci., 1931, **28** : 67-70, bibl. 4.

For Bing, Napoleon and Lambert under conditions obtaining in the Pacific North-west, the outstandingly good pollenizing variety, both as pollenizing agent and for its marketing properties, was found to be Deacon. Deacon is, however, self-sterile, and although previously one year results of Overholser and Overley had shown Bing, Lambert and Napoleon to be successful pollenizers of it, and the same report came from Summerland, B.C., the 1931 results of the writers, possibly due to unfavourable weather conditions, did not satisfactorily confirm this fact.

Growth, Nutrition, etc.

125. NAVARRO, A. 634.22-1.547.6
 Formação e desenvolvimento do gomo floral de um esporão de ameixeira
 (Rainha Cláudia). (*Evolution of the spur floral bud in the gage, Reine Claude.*)*
Revista agrônômica, 1929, 17 : 46-59, bibl. 7.

The formation and development of the spur floral bud of the plum tree (var. Reine Claude) was studied in trees of this variety grown in Central Portugal. The development of the flower bud primordia took place on 20th May and was followed by the appearance of the rudiment of the pedicel and floral receptacle. The sepal primordia were formed by 20th July, and between that date and 30th August the differentiation of the edges into petals, sepals and stamens was begun. The apparent initiation of the carpels was observed from 30th August onwards. The formation of the pollen grains and the embryo sac began on 12th February. From 10th November to 31st January the flower buds were apparently in a state of quiescence, retaining their longitudinal and transverse diameters unchanged. Flower formation in this variety of plum tree appears to be initiated at the moment when the bud manifests the first noticeable growth. (Author's summary.)

126. PARTRIDGE, N. L., AND VEATCH, J. O. 634.1/2 : 581.144.2
 The relationship between soil profile and root development in fruit trees.
Michigan State Coll. Agr. Exp. Sta., q. bull., 1932, 14 : 200-7, bibl. 4.

Since every type of soil modifies the tree roots growing on it, it is difficult to determine what form of root system is typical of any particular fruit tree. Taking as being of a fairly representative character the roots of fruit trees on a friable penetrable sandy loam, it will be found that most of the roots are in the upper one and a half to two feet of soil comprising the horizons. The densest root development in both sod and cultivated orchards is usually 6-8 inches below the surface, the moisture supply appearing to be the determining factor of the relative development in this zone. The B horizon usually contains less weight of roots per cubic foot than the A horizon. The C horizon contains even fewer roots. The lower portion of the root system penetrates to considerable depths, often forming terminal mats of fibrous roots where the soil is permanently moist. A depth of 20 feet or more may be reached. The type of root system described may be modified by unsatisfactory soil condition. Hard pans are avoided, the roots growing above or around the solidified soil block. In hard clay the roots follow the cracks and develop fan-like mats. In a compact subsoil varying in density the mass of roots will be found in the less compact portions. In lighter soils roots are more abundant in the more loamy portions, due possibly to the large supply of moisture there. Should the character of the soil prevent deep rooting, the tree is more liable to suffer from drought in dry weather. In poorly drained ground deep root penetration is impossible and the roots are confined to the well aerated portion above the water table, a restricted field which often results in stunted trees. Another unfavourable soil profile contains as subsoil deep sandy beds into which the roots penetrate deeply but from which they cannot obtain sufficient moisture in long periods of drought. It often happens that soil environments which are unfavourable to young trees become capable of exploitation by the roots as the trees increase in size, an instance being quoted of poorly grown young trees on dry soil which suddenly took on a new vigour after their tenth year. It was found on excavation that the roots had eventually reached a moist layer in the sand 8 ft. below. A reverse situation is also possible when the soil cannot supply the increased demands of the mature tree. The subsoil characteristics profoundly influence development, but the upper horizons also have their influence. Examples are cited of trees planted in the same year on ground eroded to various depths. There was a varying degree of top silt but all eventually had their roots in the C horizon. In this case the trees which had the largest supply of top silt were very much the finer specimens, the size and vigour diminishing with the supply of top silt. The paper concludes with emphasizing the necessity for a careful examination of the soil profiles before undertaking new planting ventures. Much loss has been caused in the past by failure to do this.

* Cf. Ball's account of blossom bud differentiation in Victoria, Monarch and Pond's 'Seedling' plums. *J. Pom.*, 1927, 6 : 198-208.

127. OSERKOWSKY, J. 634.13 : 581.176.1 : 581.192
Hydrogen-ion concentration and iron content of tracheal sap from green and chlorotic pear trees.
Plant Physiology, 1932, 7 : 253-9, bibl. 8.

Experiments made on material taken from normal Hardy pear trees and from chlorotic trees. The pH and the concentration of iron in the tracheal sap was found to reach a high level at the beginning of the growing season, but the period of high iron concentration was shorter than the period of low pH of this sap. No significant difference was found between the pH and iron concentration of the tracheal sap of green and chlorotic branches from the same orchard; the iron concentration might indeed be higher in sap from chlorotic trees.

128. MULAY, A. S. 634.13 : 581.192
Seasonal changes in the composition of the insoluble nitrogen fraction in the current year's shoots of Bartlett pear.
Plant Physiology, 1932, 7 : 323-7, bibl. 2.

The writer gives a brief account of his experimentation methods and tabulates his results. He finds that the composition of the insoluble nitrogen of the bark, details of which are given, seems to remain more or less constant throughout the year, except for a slight rise in amide and humin nitrogen at the start of the growing season at the expense of basic and residual nitrogen, and, as growth proceeds, for a slight fall in amino nitrogen with a parallel rise in residual nitrogen. The composition of the insoluble nitrogen of the wood is found also to be rather constant, though from June to August, 1928 a marked fall in amino nitrogen and a rise in melanin nitrogen was noted. There is a tendency for residual nitrogen to rise after the cessation of active growth.

129. MACDONALD, J. 634.11-1.55
The problem of the "off" year.
Fruit World of Australasia, 1932, 33 : 29.

In a letter to the *Fruit World* the writer, who is connected with "Argentine Fruit Distributors, Cinco Saltos, F.C.S., S. America," refers to the article by H. N. Wicks in that paper, vol. 32 : 213-5 (abstracted H.A., 1931, 1 : 3 : 232) in which the application of nitrogenous manures to apple trees in autumn is advocated as a means of eliminating the tendency to biennial bearing. It is suggested that the practice of rather drastic thinning in force in the Argentine where the same rootstock (Northern Spy) is used as in Australia, but where, unlike Australia, the problem of biennial bearing does not arise, is possibly at least a contributory cause of this happy state of affairs. In the Argentine quite half the fruit on the tree is thinned out to the space of a full hand's span (from little finger to thumb tip) or even more between each fruit. Endeavour is made to build up a good mass of healthy leaves and then to thin to the number of fruits that the leaves will support, twenty leaves being allowed to each fruit. Pruning may produce more and better leaves, but probably not in such a position as to support the fruit unless the pruning is hard. It may, however, create a better balance by reducing the quantity of fruit. Fertilizers properly and carefully applied at the right moment will aid indirectly in producing more fruit by eventually building up a bigger bearing surface and so providing more elements to care for the fruit thus borne.

130. SWARBRICK, T., AND NAIK, K. C. 634.11-1.547.4/5-1.541.11
Factors governing fruit bud formation. IX. A study of the relation between leaf area and internode length in the shoots of Worcester Pearmain apple, as affected by six different vegetative rootstocks.
J. Pom. Hort. Sci., 1932, 10 : 42-63, bibl. 26.

Shoots were grouped according to their number of internodes and the results refer to the groups containing the largest proportions of shoots. The number of internodes in these groups varied only from 18 on No. IX to 21 on No. X apple rootstock. The internode length was shortest

towards the base and apex of the shoots, longest in the intermediate region, thus expressing graphically three definite growth regions and the "Sachs Grand Period of Growth." The length and position of the region of long internodes varied with the stock and was related to its fruiting habit and its precocity. Thus on the very precocious No. IX this region was very short and near the apex. The mean internode length, and consequently the length of shoot was much shorter on No. IX than on the other stocks. On a given stock there was a close positive correlation between the area of a leaf and the length of the internode below it. The mean leaf area was least on the very vigorous B.5 and No. XII and largest on No. I, but the mean area per unit length of shoot was greatest on No. IX and least on very vigorous stocks and thus directly correlated with the precocity of the stock. M.C.V.

Cultural Practices.

131. **BAGENAL, N. B.** 634.1/7-1.543
The planting situation.

East Malling Res. Sta. Ann. Rept. for 1931, 1932, A.15, pp. 67-9.

The writer considers the salient points emerging from the work of the East Malling Station as affecting planting in its twenty years of existence. Standardization of rootstocks has solved the problem of planting distance. The drawbacks of mixed plantations have become apparent. They chiefly arise from the different nutrients, cultivation and disease control methods demanded by the interplanted crops. Experiments on small fruits have proved the need for the most rigid attention to selection, roguing and disease control. They have, moreover, proved that general advice cannot be given from experiments made under particular conditions. The best that can be expected is the selection of a short list of good varieties of any given fruit, which must be tried out under different conditions before being recommended for use under those conditions.

132. **GRUBB, N. H.** 634.11-1.542
The pruning of apple trees with special reference to standards.

Repr. *Berkshire Farmers' Yearbook for 1932*, pp. 7, and reprinted, as The pruning and renovation of apple trees, in *East Malling Res. Sta. Ann. Rept. for 1931, 1932, A.15, pp. 61-6.*

The results of fifteen years' experiments with different methods of dormant pruning at East Malling enable the writer to give the following advice. The leaders of young trees must be severely tipped once or twice to induce the growth of strong, stout shoots to form main branches. Reduced tipping should then be continued only long enough to produce a tree suitable for its purpose. Thinning out of the head will be necessary. Allowances must be made for differences between varieties. Strong growing varieties should have their heads thinned at least every other year. Where the biennial habit is developed, pruning in alternate years may help to even up the cropping, provided it is done *after the "off" year*.^{*} Experience has shown that in thinning dense trees the practice of making many small cuts is much preferable to that of removing large branches, though the latter is better than no pruning at all. Dehorning is needed chiefly by weak trees to increase their vigour. It is also useful when trees have become so tall as to be difficult to pick or spray. The practice as carried out at East Malling and recommended by the writer consisted of cutting back the taller branches by 3 feet or more, usually into the five to eight year old wood. It is recommended that each cut should be made just above a fair sized side branch, as this reduces the subsequent growth of strong shoots and water sprouts. The advantages of pruning mature trees are found to include better size and colour of fruit, easier control of fungal and insect pests, easier picking and, in cases where the tree is too weak to crop satisfactorily, heavier crops.

* Writer's italics.

133. HOFMANN, F. W. 634.11-1.542
Tabular biometrical presentation of pruning treatments with apple trees.
Proc. Amer. Soc. Hort. Sci., 1931, 28 : 613-8.

The deductions made by the statistical analysis of the results of different pruning treatments of York, Imperial and Stayman apple trees near Blacksburg, Virginia, since 1915. The writer concludes from his results, which are here tabulated : "... the chances are very good in an average Virginia apple orchard during the first fifteen years to show yield gains as follows : (1) low over high-head, (2) light over heavy, and (3) non-pruned over heavy pruned on June 20th, August 20th and October 20th. ... The higher yields are to be expected from the lower headed trees that are kept pruned with intelligent moderation during the dormant period."

134. TALBERT, T. J. 634.11-1.542
Results of some experiments in pruning young apple trees.
Proc. Amer. Soc. Hort. Sci., 1931, 28 : 610-2, bibl. 7.

A résumé of results observed from no pruning, light pruning and heavy pruning since 1923. They appear to resemble those obtained by such other named workers as Alderman in West Virginia, Pickering at Woburn, Tufts in California, Chandler in New York, Cullinan in Indiana. Open centre pruning had the greatest dwarfing effect on growth as measured by height and spread and by circumference of trunks. The modified leader system produced a marked increase in growth judged by the same standard. Unpruned trees made the strongest growth.

135. ALDRICH, W. W. 634.11-1.542.27-1.547.4/5
Effect of fruit thinning upon carbohydrate accumulation, formation of fruit buds and set of bloom in apple trees.
Proc. Amer. Soc. Hort. Sci., 1931, 28 : 599-604, bibl. 4.

A brief report on the results of one year's thinning experiments on Oldenburg, Rome Beauty, York Imperial and Delicious apple trees. Data indicate that fruit thinning of vigorous trees, if sufficiently heavy to result in a surplus of synthesized products from the leaves, will usually result in increased fruit bud formation even when done late. On non-vigorous trees such increased fruit bud formation did not occur. Thinning also greatly increased the per cent. set of bloom. (From author's discussion.)

136. HOWLETT, F. S. 634.11-1.542.27-1.55
Effect of thinning before the June drop upon fruit production.
Proc. Amer. Soc. Hort. Sci., 1931, 28 : 605-9, bibl. 1.

With several varieties of apple tested in 1930 and 1931 thinning before the June drop, by removing the competition between the adjacent fruits on the cluster base, largely eliminated the drop. It was also found that thinning early resulted in not only larger fruit being formed, but also a greater total weight of crop than was the case when thinning was done late.

Plant Protection.

137. MASSEE, A.M. 634.1/7-2.7
A simple method of forecasting insect attacks in orchards previous to the spraying season.
East Mallory Res. Sta. Ann. Rept. for 1931, 1932, A.15, pp. 78-80.

The forecasting is done as follows : A collection is made about the second week in February of shoots of the fruit trees grown from different parts of the orchards and from different parts of the trees. The shoots should be of 18 inches to 2 feet in length and should possess well developed spurs. They are placed in jars containing sand and water, in a warm, sheltered spot, such as the ledge of a southward facing window. The buds open and the insects hatch out, so forecasting

attacks of aphids, sucker or other pests. An adjustment of the method allows the grower to know when to spray his black currants for Gall Mite. The writer notes that one Kentish fruit grower has, by collecting sample shoots from his orchards, been able thus for many years to get a clear conception of the pests in his various orchards of 600 acres.

138. DUTTON, W. C. 632.95 : 634.11
Spray injury studies. I. Injuries from summer applications on apples and II. Secondary effects of spray injury to apple foliage.
Michigan State Coll. Agr. Exp. Sta. Hort. Sect. special bulletins 218, 1932, pp. 68, bibl. 27, and 219, 1932, pp. 37, bibl. 8.

Lime sulphur burn is caused by lime sulphur alone in combination with lead arsenate. It is characterized by brown leaf tissue in small or large areas. The leaves do not necessarily fall prematurely. Premature leaf fall, however, may occur to a slight degree even when the leaf injury is not apparent. The injury is less with low concentrations of lime sulphur. Lime sulphur alone causes very little russetting of fruit. The use of lime sulphur at standard concentration (2½ gallons in 100 and lead arsenate 2-3 lbs.) in mid and late summer often causes serious loss of leaves up to 50% as a result of arsenical injury, while the remaining leaves are so injured that their functions are impaired. Yellow leaf injury follows the use of lime sulphur and acid lead arsenate. This spray also causes russetting of the fruit and, on susceptible varieties, blossom-end injury. The applications most responsible for russetting have not been determined, but the petal fall and early season applications are probably important. Lowering the concentration of lime sulphur but not of lead arsenate usually reduces foliage injury and probably russetting, though this effect is not yet quite clear. Lime sulphur alone, however, causes practically no russetting. The effect of reduced concentrations on blossom-end injury has not been consistent; in some cases the injury has been greater with low concentrations. The addition of lime to the standard concentration of lime sulphur with lead arsenate has not affected the amount of foliage injury but has decreased russetting. Its effect on blossom-end injury is not established. Casein spreader has increased foliage injury in several cases. Aluminium sulphate has not prevented yellow leaf injury. This injury was much reduced by iron sulphate in the standard lime sulphate lead arsenate mixture. Dry lime sulphur has caused the same amount of leaf fall as comparable amounts fungicidically of liquid lime sulphur. Dry-mix, wettable sulphurs and other free sulphur materials in combination with lead arsenate are unlikely to cause injury to foliage, but their relatively low fungicidal value in the control of apple scab reduces their utility. Bordeaux causes very little foliage injury under Michigan conditions, but a large amount of russetting develops from early summer applications, this being definitely correlated with concentration, rate of application and amounts of copper supplied. Other copper sprays such as basic copper sulphate and copper carbonate have caused severe injury to fruit and foliage. Fruit set has not been affected except under certain unusual conditions. An excessive June drop may be caused by heavy or frequent applications or by severe lime sulphur burn during the petal fall applications. Severe injury to foliage may affect the formation of blossom buds, the size of the fruit and the colouring. In the latter instance the red colour does not develop fully. Growth of wood, determined by measurements of annual rings, is checked where the leaf area has been reduced by spray injury.

139. STEER, W. 634.711-2.76
Further observations on the habits of the raspberry beetle (*Byturus tomentosus* Fabr.) with special reference to the control of the pest by means of derris.
J. Pom. Hort. Sci., 1932, 10 : 1-18, bibl. 12.

A study of the life history of the pest suggested its attack in the larval stage. A double spraying with a proprietary derris preparation, the first ten days after the first eggs were observed and the second a week to twelve days later, gave a very efficient control on both fruits. The quality of the fruit was very much better in both cases, where the spraying was done, and the weight of marketable loganberries was increased from 8.3 to 51.8 cwt. per acre. Other possible methods of control are discussed together with their costs and the best times of application.

140. TATTERSFIELD, F. 632.951.1
The loss of toxicity of pyrethrum dusts on exposure to air and light.
J. Agr. Science, 1932, 22 : 396-417, bibl. 8.

Staudinger and Ruzicka have shown that the volatility of the active principles is not the main cause of the loss of potency of pyrethrum under certain conditions of exposure. The fact that the pyrethrins are complicated esters suggests other changes, such as hydrolysis, as a possible source of loss ; on the other hand these compounds are reducing substances and an alternative explanation might well be afforded by their oxidation. Other feasible explanations are intramolecular change or polymerization. The author finds that loss of insecticidal activity of pyrethrum powders and dusts prepared by grinding or by the incorporation of extracts of the flowers upon absorbent earths, such as talc or kieselguhr, occurs on exposure to light and air and is more rapid in the case of artificially prepared dusts than with ground flower heads. Dusts stored in closed vessels in the dark or exposed to air in the dark are relatively stable, while samples exposed to light in an atmosphere of CO₂, N, or *in vacuo* lose little of their toxicity. Samples exposed in oxygen, however, rapidly lose it. The incorporation of anti-oxidants with talc and kieselguhr pyrethrum retards such loss of activity. Tannic acid afforded considerable protection, as also such compounds as pyrocatechol, resorcinol, hydroquinone, pyrogallol. The protection was greater in the case of artificially prepared dusts than with ground pyrethrum flowers. There is no conclusive evidence that anti-oxidants, naturally occurring in pyrethrum, play any great part in stabilizing the pyrethrins against inactivation. Most of the protection would appear to be due to particle size or to cellular inclusion.

141. WILLISON, R. S. 632.8 : 634.25+634.8
Wound gum in peaches and grapes : its relation to the invasion of fungus wound parasites.
Scientific Agriculture, 1932, 12 : 402-19 and 484-505, bibl. 43.

The decomposition products, formed by the parenchymatous cells of the wood or bark dying under certain conditions of moisture and temperature in peach, ooze out into the vessels, forming wound gum plugs which later become lignified especially on the border between living and dead wood. The wound gum is not soluble in hot or cold water and does not even swell. In the grape vine wound gum plugs are not formed in the vessels, since these are already filled with a jelly-like substance formed from the sap which swells and is, partially at least, soluble in water. Another gum is produced in the peach by pectic substances and the disorganization of cell contents, gum pockets being formed in injured meristematic tissue by reason of the dissolution of the middle lamellae. This gum, if exuded, undergoes no further change and is partly water soluble and capable of swelling in water. If, however, it becomes embedded in the wood, it takes on the characteristics of wound gum and is often impregnated with lignin. The browned tissue in grape wood due to the presence of the above mentioned decomposition products does not prevent the invasion of the wood by *Cryptosporella viticola*. Hyphae of *Cytospora* and *Sclerotinia* can penetrate wound gum plugs in peach wood by means of appressoria and slender penetration threads. In nature *Sclerotinia* does not long survive in the wound gum region probably through lack of moisture. *Cytospora*, however, lives on from year to year in the wound gum impregnated wood. When a wound is infected with *Cytospora* the wound gum region is more extensive than in uninfected wounds. There is some evidence that a toxic substance which kills the wood and promotes the formation of wound gum is produced by both of these fungi. Invasion by *Sclerotinia* seems to be inhibited by the presence of wound gum, but to *Cytospora* it is not an impenetrable barrier.

142. BURKE, E. 634.11-2.191
Chlorosis of trees.
Plant Physiology, 1932, 7 : 329-34, bibl. 8.

An account of experiments conducted in an apple orchard, many of whose trees were failing to make normal growth and several dead. The leaves on the chlorotic trees were small and yellow and the trees had made little or no growth. Preliminary examination of the soil showed that

insufficient alkali salts were present to cause injury and that there was no serious waterlogging of the soil. An average analysis of the second foot of soil showed a calcium content of 14.53% and iron 1%. Neither spraying with a 0.5% solution of ferrous sulphate nor applying ferrous sulphate to the soil remedied the chlorotic condition of the trees. Internal treatment with iron salts, both as solid salts and in dilute solution gave beneficial results. Another simpler method available to any orchardist was slower but quite efficacious as a remedy. This consisted of driving iron nails into the trees. Heavy finishing nails 1-1½ inches long were driven carefully into the tree—with a nail set to avoid injuring the bark—so that the heads were completely below the bark. In the case of branches some 8-10 nails were used, and 15-20 for trunks.

143. V. D. MERWE, C. R.

632.51

Jointed cactus and its eradication.*Farming in S. Africa*, 1932, 6 : 495-7.

Opuntia aurantiaca is a major imported weed pest in S. Africa. It possesses extraordinary vitality and spreads with almost incredible rapidity, the smallest fragments of the brittle shoots, which are armed with spines, enabling them to cling to and be carried about by man and beast. They root immediately where they fall. The older plants develop a sappy underground bulb which makes the work of eradication difficult. A series of field experiments, however, have proved that the pest can be totally exterminated by light spraying with solutions of arsenic-pentoxide of soda or arsenite of soda at strengths of 24 lbs. and 36 lbs. per 100 galls. respectively. Weaker solutions lead to waste and the dripping off of surplus liquid, a fact which enables some of the fruits to escape, while stronger solutions destroy the growth above ground so rapidly that the poison is not able to circulate through the plants to reach the underground bulbs. Dew, rain or fog prevent the spray having its full effect, so that the work should only be done when the plants are dry.

144. MUSKETT, A. E.

634.95-2.51-2.4

The control of diseases and weeds in a forest nursery.*J. Min. Agr. Northern Ireland*, 1931, 3 : 102-15, bibl. 18.

A very satisfactory control of conifer seedling diseases caused by *Corticium Solani* and *Botrytis* sp. has been obtained by treating the seed beds at time of sowing with a solution of sulphuric acid (1 in 80) applied at the rate of 1 gall. per sq. yd. At this strength a valuable control of weeds was also obtained reducing the weeding expenses by 30% after allowing for cost of material and its application. The use of Cheshunt compound, formaldehyde, mercuric chloride, cresylic acid and a weaker concentration of sulphuric acid did not prove to be so satisfactory. Cheshunt compound had a marked manurial effect on the seedlings, also on the weeds.

145. MERCER, S. P.

632.51

Creeping thistles.*J. Min. Agr. Northern Ireland*, 1931, 3 : 143-51.

An account of attempts at control. At Hillsborough finely crystalline chlorate of soda hand sown in November, at a rate of 300 lbs. per acre on arable land completely destroyed a heavy crop of perennial creeping thistle, without harming the subsequent crop of oats and potatoes. Weed seeds were not killed. Nettles and docks have also been destroyed and other weeds reduced by the same means. In Northumberland a sharp hoe gave better results in the destruction of pasture thistles than the mower or rotary thistle cutter. In county Down two cuttings given early (June) reduced the following June crop of pasture thistles by 90% at a total cost of about 30s. per acre. When the cutting was delayed till July a very large disadvantage was evident. In this experiment the cuttings were made with the point of the scythe. One cutting, however early, proved insufficient.

SMALL FRUITS, VINES, NUTS.

146. **HARDY, M. B.** 634.711 : 581.162.3
Self and cross fertility of red raspberry varieties.*
Proc. Amer. Soc. Hort. Sci., 1931, 28 : 118-21, bibl. 3 and
Red raspberry pollination technique.†
ibidem, 122-4, bibl. 2.

The writer's work leads him to confirm the findings of Hooper and Chandler that the common varieties of red raspberry are self-fruitful. The viability of the pollen differs however, necessitating in hand pollination work that sufficient pollen shall be applied to the pistils at the correct time. The responsibility for failure rests therefore on the technique observed. The technique with which the writer achieved most success at the Western Washington Exp. Sta. at Puyallup and which he commends is as follows: The flowers to be pollinated were selected on shoots on which there were six or seven that had reached approximately the same stage of development. All farther or less advanced flowers were removed. The flowers to be pollinated were selected so that the flower most advanced in development was showing no more than the initial splitting apart of the sepals. When the blossoms were emasculated just as or before the petals were beginning to show, none of the anthers had begun to shed pollen. Emasculation was accomplished by cutting around the stem of the flower bud with a sharp scalpel while holding the inverted bud between the thumb and forefinger, the cut being made about half-way between the stem and the largest circumference of the bud. The cut is thus made just below the point of attachment of the stamens and petals. The emasculated flowers were then covered with a white paper sack (actually opaque manilla bags) fastened tightly round the base of the fruiting shoot. The flowers from which pollen was obtained for either cross or self-pollination were covered with a paper sack before any had opened. When pollen of a particular variety was required, a sack covering a shoot of that variety was removed and a number of open flowers with dehiscing anthers picked off with tweezers and placed in a tin box marked for that variety alone. This was taken to the emasculated flowers to be pollinated, the paper sack over the latter removed and the anthers of the pollen parent flower brushed lightly over the pistils. This pollination was done from two to five days after emasculation and every day thereafter until the pistils began to turn brown. Self-pollinated flowers were not emasculated but were allowed to bloom normally under paper sacks. A flower of the same variety which was blooming and shedding pollen under another sack was used to spread pollen over the pistils.

147. **DARROW, G. M.** 634.713
The Brainerd blackberry.
U.S. Dept. Agr. Circ. 220, 1932, pp. 4.

A description of a cross of the Himalaya and an erect growing variety from the Eastern United States (possibly Georgia Mammoth). Its qualities are given as extreme vigour, great productiveness, entire hardness where tried, size and dessert quality of fruit when fully ripe. Its weaknesses are large prickles, a peculiar variegation of the leaves, lack of quality until fully ripe, susceptibility to orange-rust disease in the East and to double-blossom disease in the South-East. Canning, preserving and frozen pack tests at the Oregon Experiment Station show its desirability for those purposes and superiority to the Himalaya. It is propagated fairly freely by tip layering and very freely by root cuttings.

148. **HARRIS, R. V.** 634.75-1.541.1-2.8
Grafting as a method for investigating a possible virus disease of the strawberry.
J. Pom. Hort. Sci., 1932, 10 : 35-41, bibl. 8.

The writer gives a detailed, clear account of the different methods used by him in grafting and inarching strawberry plants, thereby showing a method for determining the possible virus nature of certain diseases on this plant, which does not involve the infestation of plants with suspected

* Sci. Paper No. 197, College of Agriculture and Exp. Station, State Coll., Washington.

† Sci. Paper No. 198, College of Agriculture and Exp. Station, State Coll., Washington.

insect vectors and so introduce the masking factor of direct insect injury. He states the measure of success obtained by the different methods. The variety used was Royal Sovereign.

Cleft grafting of crowns was entirely unsuccessful.

Cleft grafting of stolons achieved complete success in three out of twenty-eight or 8% of cases, the writer suggesting that causes contributing to the failure were probably lack of practice in manipulation, mite infestation of material and disease of stock or scion in nearly every case.

Inarching of stolons, an account of two methods being given, was on the other hand very successful. It was found possible to graft a runner from one plant on to the stolon of another without completely detaching this runner from its parent plant till after union had taken place. Consequently no special precautions to reduce the transpiration of the grafted runner were necessary. In the first method the runner from the stock plant was discarded and its stolon was then grafted into the scion-stolon. After union the scion stolon was severed leaving the scion-runner connected to the stock-plant. In the second method neither of the runners on the grafted stolons was removed. After union one of the stolons was severed leaving one stolon bearing its own runner and an additional runner grafted on it. Seven out of eight grafts by the first method and four out of five by the second method were successful.

149. SNYDER, E.

634.851-1.523

A preliminary report on the breeding of Vinifera grape varieties.

Proc. Amer. Soc. Hort. Sci., 1931, 28 : 125-30, bibl. 16.

Notes on work since 1923 at Fresno, California. The chief aim has been the production of more seedless varieties and better table and raisin varieties. The production of seedless varieties has received the most attention. So far Black Monukka, Sultanina, Sultanina rosea, Panariti, Corinthe rose, and Corinthe blanc (all seedless) have been used as male parents in various crosses. Of the crosses fruited to date one seedless progeny resulting from Gros Guillaume and Black Monukka is mentioned as having possible commercial merit. It is similar to Black Monukka but apparently its berries adhere better to the pedicels.

150. GLADWIN, F. E.

634.846-1.541.11

Grafting American grapes on vigorous stocks.

New York Agr. Exp. Sta. Geneva, bull. 607, 1932, pp. 28.

The following stocks were used : Clinton, Riparia Gloire de Montpellier, Rupestris St. George du Lot, Rip. \times Rup. 3306, Worden \times 3306. The soil in all cases but one was Dunkirk gravelly loam, Concord being tried on this and on Dunkirk silt loam also. One year rooted stocks were bench grafted in the spring of 1914, grown in the nursery a year and planted out in 1915. Of the varieties tried Catawba, Niagara and Delaware did best on Clinton and the gain in quantity and quality of fruit was highly profitable. Iona was particularly well suited by Rupestris St. George and by Clinton. Concord on gravelly loam did best on Riparia Gloire, while on silt loam working on Clinton tremendously increased its fruit production. The author concludes that varieties unsuited to certain soil types may be adapted by top working to a suitable rootstock. The stock influence was shown only in fruitfulness, vigour and quality of fruit. There is indication that scions of varieties inherently lacking in vigour slow down root activity of vigorous stocks.

151. LUTHRA, J. C., AND CHIMA, I. S.

634.8 : 581.12

Some studies in respiration and other metabolic activities in berries of the grape vine (*Vitis vinifera*).

Indian J. Agr. Sci., 1931, 1 : 695-714, bibl. 14.

In the berries of the Jaishi and Tur varieties it was found that respiration in the early stages of their growth was very active and later slowed down. It was apparently retarded by the increasing sugar accumulation. The rate of respiration of attached and detached bunches was found to be the same. Night respiration was only slightly lower than that in the day. Reducing sugars showed a steady increase throughout ripening. Total titratable acids increased for four or five weeks and then fell. Nitrogen declined consistently till the forty-sixth day. On the seventy-

fifth it was found to have risen again. Water insoluble residue remained practically constant. Specific gravity of the grape juice kept pace with increased sugars. Cellulose content remained stationary throughout. The co-efficient of correlation between sugars and acids was -0.78 ± 0.08 in Jaishi and -0.921 ± 0.03 in Tur.

152. BARNARD, C.

634.8-1.547.4/5

Fruit bud studies : 1. The Sultana.

J. Council for Scientific and Industrial Research, Aust., 1932, 5 : 47-52, bibl. 2.

An analysis of the distribution and behaviour of the buds of the sultana vine together with an account of the differentiation and development of the fruit buds. Records taken during four successive seasons showed that only 56% to 60% of the buds, which are present on the vine at the end of winter, develop into shoots in spring, and of these from 56% to 76% are fruit bearing shoots. The proportion of buds which develop into shoots is least at the base of the cane and increases progressively towards the distal end, and a higher proportion develop on medium length canes than on long ones. The proportion of fruit buds is low towards the base of the cane, increases progressively outwards, and falls off towards the distal end in all except very short canes. The seasonal variation in the proportion of fruit buds present is largely dependent upon the number of fruit buds formed on the distal half of the cane. In the 1928-29 season the investigation showed that the basal buds were differentiated by about 12th November (Australia) while for buds of the sixteenth node the date was 11th December. (From author's summary.)

153. SITTON, B. G.

634.512-1.541

Vegetative propagation of the black walnut.

Michigan State Coll. Agr. Exp. Sta. tech. bull. 119, 1931, pp. 45, bibl. 62.

The investigations here recorded were undertaken to discover the reasons for the uncertainty attending the vegetative propagation of *Juglans nigra*, unequal success being frequently achieved under apparently similar conditions by the same operator. The behaviour of walnut scions on grafting was not altered by previous nitrogenous manuring, by girdling the shoots, or by chemical treatment of the shoots. Partial defoliation reduced the number of scions which formed callus. Patch budding has possibilities but requires further experimentation. The time of budding has been found to be of importance. Anatomical studies show that compared with the apple the walnut is more sensitive to wounds and that the healing processes are slower. New tissue in the walnut is capable of changing direction to meet changed conditions of sap flow. The scions giving best results were those of two year old wood having a diameter of $\frac{3}{8}$ to $\frac{1}{2}$ inches. The percentage of scions forming callus was independent of the size of the pith. Scions having a thick bark gave better results than those with thin bark. At a controlled temperature of 28° C. relative humidities of 75% or greater gave satisfactory results. The optimum temperature for callus formation seems to be about 28° C. or 82° F.

154. SHUHART, D. V.

634.521-1.547.4/5

Morphology and anatomy of the fruit of *Hicoria pecan*.*

Bot. Gaz., 1932, 93 : 1-20, bibl. 18.

This may be considered as a synopsis of work on the morphology and anatomy of the fruits of the *Juglandaceae* with special reference to the pecan. A detailed and illustrated botanical description is given of the internal anatomy of the flower, the fertilization of the ovule and its subsequent growth. The fruit is found to be a kind of pome fruit, consisting of a specialized stem, which surrounds a normally two-carpelled but single-ovuled ovary. It matures dry, dehisces along four parenchymatous rays and at the surface of the carpels. It includes the true fruit, which is a nut formed by the lignification of the exocarp into a hard shell surrounding a single, loose, two-lobed orthotropous seed, the embryo of which has bifurcated and folded cotyledons

* Contribution from the Hull Botanical Laboratory 427.

155. WAHLBERG, H. E.

634.521

Yuma Valley pecan growers prosper.

American Fruitgrower, 1932, 52 : 1 : 8-9.

An account of a new horticultural venture in Arizona. Although the pecan is indigenous to districts where the annual rainfall is from 25-50 inches, it is nevertheless adapting itself admirably to the conditions in Arizona where the humidity is very low and the rainfall less than 3 inches. The water table is, however, only 10 feet below the surface, and under these conditions five or six irrigations are given annually. The principal varieties in use are Stuart, Schley, Success and Burkett, Kincaid and Halbert. The inferior seedling trees planted originally have been top-worked to one or other of these varieties. Schley is subject to splitting, attributed by growers to sudden changes in the soil moisture content of the rooting zone. If a uniform moisture content can be maintained, there are few splits. Harvesting is carried on by knocking the nuts off the trees with long poles. Canvas sheets are spread under the trees to receive them. So far pollination difficulties have not presented themselves. Every orchard contains more than one variety and cross pollination can take place within a radius of a mile assuming a wind of twenty miles per hour. In some orchards cotton is used as an intercrop with a time limit of four years, the cotton rows being kept 10 feet away from the trees. Leguminous cover crops are also used. This particular district is happily free from pests and diseases, but in other States 25-35% loss of crop has been caused by case bearer and other pests. The average crop per tree of a successful grove is about 40 lbs. at six years of age, 60 lbs. at seven years and 80 at eight years.

CITRUS AND SUB-TROPICAL FRUITS.

156. FRIEDMAN, A.

634.3-1.521

Citrus varieties other than Shamooti and Marsh Seedless grapefruit that can be produced commercially in Palestine.

Hadar, 1932, 5 : 85-9.

Varieties are suggested which mature earlier than the Shamooti (Jaffa) orange and so reach the market when citrus fruit is scarce and others which will remain on the trees until after the Shamooti has been harvested. The early oranges proposed are the Spanish varieties Cadena and Veceda and the Florida Pineapple, all of which mature three weeks earlier than Shamooti. The two former are worked on sour stock, while Pineapple will succeed on sour orange or sweet lime. Of the three Pineapple, the most widely planted of Florida oranges, is superior both in flavour and as having fewer seeds. In the mandarin group Clementine can be picked in October. It succeeds on sour orange and sweet lime, being larger and earlier on the latter. Satsuma is a favourite with those who prefer a low acid content. It is more cold-resistant than any other variety. Its stock is the sour orange. For late maturity the Valencia Late is recommended. The standard grapefruit type in Palestine is Marsh Seedless. Duncan is recommended for growing as well, since it is a high quality fruit, maturing considerably earlier than Marsh. The Foster grapefruit, a pink-fleshed variety, is recommended as maturing late in the season, being practically seedless and of fine flavour. [These recommendations are particularly interesting in view of their divergence from opinions expressed by such authorities as Hume and Coit on several points. Thus Hume in *The cultivation of citrus fruits*, 1930, p. 210, writes that the trifoliate stock "is the only satisfactory one to use for the production of high grade Satsuma oranges. On all other stocks this variety does not bear large crops or the fruit is practically worthless," and on page 213, "the sour stock . . . is not suitable for the Satsuma orange." Again both Hume in the same book, p. 100 and Coit in *Citrus Fruits*, 1927, p. 77, writing of American conditions, say that the Duncan season is late, as does also Swingle, W. T., in Bailey's *Standard Encyclopaedia of Horticulture*, 1927, p. 1391. Moreover the Marsh season is stated by Hume to be February and March in Florida, and by Coit as March to July in California. Further, Hume, p. 106, describes the Foster as an early—mid-season sort.—ED.]

157. SHAMEL, A. D. 634.33 : 575.252

A pink-fruited lemon.

J. Heredity, 1932, 23 : 23-7, bibl. 1.

The author, on tracing the origin of a lemon exhibited at the National Orange Show held at San Bernardino, California, in February, 1931, found a tree identical in appearance and all observed characteristics with those of the Variegated Eureka lemon bud variation noted by him in 1920, except that the fruits in the new variation develop a decidedly pink colour of rind, flesh and juice as they reach maturity. The tree stands among other normal orange and lemon trees of several varieties and is a healthy, fine tree. The pink colour is not observable in young fruits. Several small branches were found on the pink-fruited tree, which were apparently wholly green in colour of leaves, bark and fruit. Other small branches were noted, where the stems and leaves were nearly if not wholly white, but none of them bore fruits. The tree is believed to be a bud sport of the Eureka lemon. It is now being propagated by bud wood by the author at the Citrus Experiment Station of the University of California.

158. SWINGLE, W. T., AND OTHERS. 634.3 : 575.12

New citrus hybrids.

U.S. Dept. Agr. circ. 181, 1931, pp. 19; bibl. 17.

Notes are given on many different types, especially tangelos. *Citranges*. These are crosses between the deciduous trifoliate orange (*Poncirus trifoliata*) and the common sweet orange (*Citrus sinensis*). They are noted as being the hardiest edible citrus and as making excellent stocks for the commonly cultivated citrus. *Limequats*. These are hybrids of the West Indian lime (*Citrus aurantifolia*) and the kumquat (*Fortunella japonica* and *F. margarita*) and may be regarded for practical purposes as hardy limes, the fruits being similar but the trees more cold resistant and resistant to wither tip (*Gloeosporium limetticolum*). *Citrangquats* are hybrids of the citrange and the kumquat. They are harder than the lime and limequat, but have acid and inferior fruits. They seem to be fairly well adapted for use as stocks. *Tangelos*. These hybrids between the tangerine (*Citrus nobilis deliciosa*) and the grapefruit (*C. grandis*) were one of the first citrus crosses to be undertaken. They comprise a whole series of orange-like fruits, many being beautifully coloured and of exquisite flavour and aroma. The writers describe in detail eleven tangelos. Unfortunately the delicious "soft and melting pulp" of the tangelo causes the fruit to break down in many cases, when shipped to distant markets. Part of the aim of those breeding new tangelos has been to eliminate this difficulty and a certain amount of success has been achieved. For propagation purposes the following comments of the writers on the Sampson tangelo may be of interest. "Like many of the citrus hybrids it comes true from seed with striking regularity. Hundreds of seedlings have been grown without revealing vegetative diversity. . . . In vegetative propagation the Sampson, as well as most other tangelo varieties, differs from the parental fruits. Cuttings of the tangeline and the grapefruit may be rooted, but with considerable difficulty. . . . Leafy twig cuttings of the tangelo, however, may be rooted without difficulty and with only moderate loss if care is taken. . . ." A note is given on the *Glen citrangedin* which is the result of hybridizing the Willits citrange with the calamondin. It is found to combine to a large extent the extreme hardness of the citrange with the high acidity and excellent flavour of the calamondin. It is without any trace of the repellent bitter flavour carried by the citrange. The rootstock recommended is the trifoliate orange or, under colder conditions, the citrange. The *Perrine lemon*, a hybrid raised by crossing the common Mexican lime (*C. aurantifolia*) with the ordinary lemon (*C. Limonia*), gives promise for use as a substitute for lemon in Florida, where lemons normally grow coarse and puffy. It has so far proved itself highly resistant to lime wither tip and citrus scab.

159. WEBBER, H. J. 631.521 : 581.163 + 581.165

Effect of selection within apogamic and clonal progenies.

Proc. Amer. Soc. Hort. Sci., 1931, 28 : 53-6, bibl. 5.

Although apogamy and vegetative propagation provide means of producing large numbers of plants of like genetic constitution, such plants are found to exhibit a considerable range of

variation in size. Bioletti, testing the effect of size of rooted vine cuttings, found that it was very marked during the first three seasons in the vineyard, was noticeable in the fourth, but had largely disappeared in the fifth. He notes that in the third season "the value of the extra crop was much greater than the total cost of the best rootings." The writer has found in the last twelve years that within comparatively homogeneous, apogamic seedling progenies of citrus the large seedlings in general produce larger buddings than the small seedlings of the same progeny and that this larger size is maintained in the orchard for several years. Trees on large seedling stocks during the first eight and ten year periods in the orchard have yielded over 19%, more than comparative trees on small seedling stocks from the same apogamic progeny. It is also apparent that, although this difference tends gradually to disappear, some difference remains up to the close of the eighth year in the orchard. The writer interprets the result as being entirely due to the hold-over influence of large size and vigour in the young seedlings or cuttings. In long-lived slow-growing perennials such as citrus the advantage may be maintained for many years. Although any result obtained by such selection is not likely to affect the heritage of the plants, he concludes that selection for size of apogamic seedlings or clonal material is economically sound. [Vegetative stocks have long been graded to size in commercial European nurseries.—ED.]

160. WEBBER, H. J. 581.141 : 634.3+634.441
The economic importance of apogamy in citrus and mangifera.
Proc. Amer. Soc. Hort. Sci., 1931, 28 : 57-61, bibl. 8.

The author notes the fact that citrus and mangifera have evolved the ability to produce viable apogamic (asexual) embryos in the seed which have no direct relation to the regular egg apparatus and fecundation. They arise from the specialization of certain cells in the nucellus of the mother near the wall of the embryo sac. These cells grow and divide rapidly, and finally form masses of tissue which push out into the embryo sac and form embryos, which cannot be distinguished in the seed from those developing from the egg cells proper. They carry the full diploid chromosome complement direct from the mother and transmit the same heritage as the mother type. Sometimes the one sexual embryo present is crowded out or fails to develop, in which case all the embryos are apogamic. This phenomenon of apogamy presents considerable difficulty to the breeder but may be turned to good use by the nurseryman, who should thus apparently be able to obtain easily from any good stock type large batches of seedlings, which can be depended upon to be of nearly uniform genetic type and to react uniformly on the scion. The percentage of apogamic embryos in certain citrus species and varieties used as stocks varies considerably and is of great significance in the production of uniform stock. A factor of exceptional interest is the high percentage of apogamy exhibited by some F1 hybrids of radically distinct species and the fact that such hybrids are often exceptionally vigorous and likely to be valuable as stocks. Thus trifoliolate orange (*Poncirus trifoliata*) [72% apogamic] crossed with sweet orange (*Citrus sinensis*) [40-95% apogamic] gave rise to F1 hybrids, which have been called "citranges" and have already attracted attention as desirable stock types. Progenies of several hundred plants each of several of these hybrid varieties have been grown in connection with the writer's experiments and have been found on examination of three year old seedlings to have reproduced apparently true to the variety type in all cases. In other words the seedlings may be considered as approximately 100% apogamic. Seedlings of the Sampson Tangelo (Grapefruit × Tangerine) have also been found equally apogamic. The writer has, indeed, found that among the progenies of varieties and species that are not completely apogamic there is a small proportion of seedlings that differ from the prevailing type. Such are almost certainly produced from the sexual embryos, probably by self fertilization, are generally small, and almost invariably produce some degree of dwarfing on scions. The roguing of these variants from among nursery seedlings before budding is of the utmost importance, when the seedlings which remain can be safely considered to be chiefly of apogamic origin. Regarding mangos (*Mangifera indica*) an examination of the Peach mango in the Transvaal leads to the conclusion that the degree of apogamy is approximately 100%. The same is apparently true of the Saber mango. Since seedling propagation is cheaper than vegetative, it would seem worth testing the degree of apogamy in valuable mango varieties before resorting to vegetative propagation.

161. HUNTER, R. E.

634.3-1.533/535

The vegetative propagation of citrus species.*Proc. Agr. Soc. Trinidad and Tobago*, 1932, 32 : 53-8.

Various methods are discussed. *Root cuttings* consist of pieces of root 6 inches in length, set horizontally in clean sand about an inch below the surface, in a propagator. When callus formation on the cut ends has occurred, buds will form on the callus at one end and will develop into shoots. The new shoots at first have no root system, so that until this is formed the air in the propagator must be kept thoroughly saturated with moisture. Sour orange and other difficult varieties do not root readily. The method is impracticable for rapid production on a commercial scale. *Stem propagation* comprises several methods: (a) Wiring, in which a light copper wire is wound round a stem and the wire portion either covered with earth if low enough, or with moss kept damp if above ground. When roots develop the branch is cut off and planted. The method is a fairly quick one with limes, but with the difficult orange and grapefruit it may take many months. [Oppenheim in Palestine produces roots in sour orange without difficulty in two months by the wiring method (see No. 162 of this issue) —Ed.] (b) Ringing or marcottage involves the removal of a ring of bark round the stem, carefully cleaning all soft tissue from the wood. The ringed portion is bound in moss which must always be kept damp. Sooner or later roots will appear in the callused portion above the ring. The method is fairly certain but too laborious for commerce. (c) Cuttings of hardwood do not root very easily. To ensure callus formation water must be given only sparingly and the cuttings must be planted in coarse sand, the temperature being kept fairly high, 30°-35° C. When callusing has been achieved the watering must be increased. The age of the cutting has been found to have a marked influence on the time taken for roots to appear, as does the size of the grains of the sand in which they are struck. (d) Ringed hardwood cuttings are made by ringing the bark as in marcotting but not covering it afterwards. Subsequently the ringed portion is cut through in the centre of the ring and the shoot is treated as a cutting. The time elapsing between ringing and planting is of some importance, fifteen days being the optimum with Rangpur Lime. (e) Softwood cuttings are made of young shoots 6 inches long and thinned to five or six leaves. They are set in clean sand in a propagator, the air within being kept in a high state of humidity. The cuttings, when taken, should be placed immediately in a wet sack until planted. Sour orange with these methods will root in forty to sixty days and grapefruit in fifty to eighty days. The easier varieties will root very much quicker.

Leaf Propagation. Leaf cuttings can be made in two ways, either by cutting through the leaf stalk, or by cutting off a slip of the stem, as in budding, with the leaf attached. The former "leaf only" type is not satisfactory owing to the length of time taken to produce growth. The second method, however, produces roots in about the same length of time as the softwood cutting method and is considered very promising, since the sets take up far less room than cuttings in the propagator and many more may be raised from a given amount of propagating material.

162. OPPENHEIM, J. D.

634.3-1.535

A new system of citrus layers.*Hadar*, 1932, 5 : 2-4, bibl. 3.

A system of layering described by Höstermann as being successfully used in the Argentine for difficult subjects, including a large number of citrus varieties, was put into practice in Palestine and is here reported. Höstermann has named one method the Dahlemer Drahtungsverfahren (Dahlem wiring method*). Oppenheim's wiring experiments were carried out in 1931, beginning in April. The plants used were *Poncirus trifoliata*, sour orange and sweet lime. Year old seedling plants were cut back to within 20 cm. of the ground in early spring. In six weeks' time new shoots had sprung up and were large enough for treatment. Two thirds of the shoots on each stump were dealt with, the remaining left to carry on their natural functions and maintain the plant in health. The treatment consists in winding a thin copper wire three or four times round the stem of the shoot about 7 cm. from the main stump. The wire must not be tight enough

* *Berichte der Deutschen Botanischen Gesellschaft*, 1930, Band 48, Heft 2, S. 66-70.

to injure the bark when first put on. After wiring earth is mounded up round the tree to about 15 cms. above the rings and kept moderately moist. As the shoots continue to swell, the wire penetrates the bark, usually within a month; rooting has begun in two months through the bark above the wire and in four months a useful root system has developed. A sweet lime wired in April was in December found to have a diameter of 17 mm. above the ring and only 6 mm. below. An advantage of the method is that owing to the slow penetration of the bark by the wire open wounds are not made and there is no danger of infection. In the ordinary citrus cutting the roots appear to grow from the callus itself though in reality they start above the callus and grow downwards between the bark and the wood only becoming visible after penetrating the callus. In the wire bound branches the roots grow directly through the bark above the ring and are stated to be far better developed than those of cuttings or even seedlings of the same age, as indeed is the whole resulting plant. It is true that sweet lime can be made to root merely by mounding the soil around it, but the roots are weaker than those produced when the wiring system is used, while the difficult sour orange and trifoliata are successful when treated with the rings but give no response without them. Höstermann found that he could conduct grafting and rooting operations simultaneously. He budded or grafted stems of *Rosa canina*, *Ribes aureum* and others at the time of wiring, so that in a few weeks the new complete plant, comprising rooted stock and a growing scion, was ready.

163. NAMBU, H. 634.3-1.547.4/5
The flowering habit and the fruit bud formation in Citrus. [Japanese-English summary.]
Communication Hort. Inst. Taihoku Imp. Univ., 1931, No. 21. Repr. from
Studia Citrologica, 1931, 5 : 21-32, bibl. 18.

The differentiation of flower buds in Citrus is a problem that has not yet been adequately investigated. Working in Northern Formosa the author found that differentiation did not occur before the early part of December except in the perpetual flowering *Citrus microcarpa* Bunge, and that initiation takes place just at the time of the spring flush. The wood on which the bud appears is not limited to a spring shoot which was sterile last season, but may be a last year's bearing shoot or even a late autumn growth. During dormancy no preparatory morphological change of the growing point could be detected and the author is convinced that, morphologically at any rate, differentiation does not occur till after the winter dormancy.

164. DEWALD, J. P. 634.3-1.87
The evil of clean cultivation.
The Citrus Industry, 1932, 13 : 2 : 20.

Continuous clean cultivation is stated to be nothing but harmful in an orange grove. It is, however, difficult to dislodge the old conventional idea that the presence or absence of weeds is a measure of the farmer's ability. Any system which does not provide for the incorporation of organic matter into the soil is bound to fail in the end. Frequent cultivation destroys the surface feeding roots and develops a cultivation sole within a few inches of the surface, preventing the penetration of irrigation water and so restricting root growth. A systematic growing of cover crops is advocated, of leguminous plants if possible, but of weeds if nothing else is available. A larger supply of irrigation water will be needed with cover crops to prevent their roots coming into competition with the tree roots during the dry season. Cover crops can be grown at any time of the year with young trees, but with bearing trees they must be turned in before the blooming period of the trees and again before the harvest.

165. OPPENHEIM, J. D. 634.3-1.67
The necessity and future aspects of an intelligent soil moisture control in our orchards.
Hadar, 1932, 5 : 39-42.

Over irrigation is an unfortunate feature of citrus cultivation in Palestine, though steps are now being taken to control this. The evils resulting from this practice are described, and it is

recommended that a small soil moisture laboratory should be established to investigate (1) the monthly and seasonal irrigation requirements of orchards in different parts of the country, with and without cover cropping ; (2) the required frequency of irrigation and the amount of water necessary on different soil types ; (3) the efficiency of different types of irrigation such as furrow, basin or overhead on different soil types.

166. MATSUMOTO, K. 634.451 : 581.12
Effect of seed-formation on the rate of respiration of the fruit of the Japanese persimmon or kaki (*Diospyros Kaki* L. f.).
Japanese J. Bot., 1932, 6 : 125-37, bibl. 16.

This gives the results of experiments during 1928, 1929 and 1930 with a variety Kubo (pollination variant) and in 1929 and 1930 with two varieties, Fuyu and Jiro (non-astringent pollination-constants). Two astringent varieties, Hagakushi and Yotsumizo (astringent pollination-constants) were also used in 1930 and 1931. The apparatus used for measuring the CO₂ was of the current type and an illustration is given of it. The writer found that under similar environmental conditions a fruit with seeds expires much more CO₂ than a fruit without seeds in the case of Kubo, Fuyu and Jiro. Sugar analysis gives little information to explain the correlation between seed formation and respiratory intensity. The respiratory processes of kaki fruits were markedly accelerated by treatment with acetaldehyde, especially when immature. Alcohol did not show any stimulating effect in the experiments here discussed.

167. DAVIS, W. B. 634.3 : 668.526.4 : 581.192
Deposits of oil in the juice sacs of citrus fruits.
Amer. J. Bot., 1932, 19 : 101-5, bibl. 16.

Deposits were found in immature, mature and over mature fruits of all sub-varieties tested of the following : *Citrus sinensis* 13, *C. nobilis* 3, *C. nobilis* var. *deliciosa* 3, *C. nobilis* var. *unshiu* 1, *C. Webberi* var. *montana* 1, *C. mitis* 1, *C. hystrix* 1, *C. aurantifolia* 7, and *C. maxima* 6, and of 15 hybrids, while they were absent in 2 specimens of *C. Limonia* out of 8, in 1 of *C. Aurantium* out of 7 and absent in 4 out of 4 citron varieties (*C. medica*). They were quite prominent in the trifoliate orange, in the citrange and in grape fruit, and could be seen without a lens in many varieties of orange. In lemons and limes they were much less conspicuous. The study which was made of plantings of the Citrus Experiment Station, Riverside, California, is preliminary to a chemical investigation of the deposits and their effect on the flavour and keeping qualities of citrus fruit juices.

168. LORD, E. L. 634.3-1.821
Calcium requirements of citrus.
Citrus Industry, 1932, 13 : 4 : 6-7, 22, 26.

A plea for a judicious increase in lime application to citrus groves. The writer discusses experimental work on the calcium content of citrus as influenced by nutrient medium, on the effect of calcium carbonate on nitrate formation in acid and alkaline soils, its effect in raising the toxic limit in certain citrus soils of low water-holding capacity, where without it certain mineral fertilizers may easily surpass the limit. In Florida he considers that the hydrogen-ion concentration of the soil in the grove gives a workable basis for calcium treatment. He notes that $\frac{1}{10}$ of the citrus production in Florida, namely that on soils of high lime content, has consistently received better prices than the rest. Dealing with the chief sources of lime he discusses the merits and use of the following, all of which may be valuable under certain conditions in Florida : ground limestone screenings, wood ashes, raw phosphate rock.

169. ZEILINGA, A. E. 634.3-2.4-1.541
Wortelvernieuwing bij gomzieke citrus-boomen. (**Root renewal in citrus trees suffering from gum disease.**) [Dutch-English summary.]
Landbouw, 1931, 7 : 372-84.

A method of inarching is described and illustrated. Inarching has been found necessary in order to restore trees damaged by gum diseases due to *Phytophthora parasitica*. The experiments were very successful, though there was a subsequent mortality in the first year of 16%. Tables show the average healing after three weeks, amounting to 76%. Other figures are given to show the first measurement before inarching and the subsequent enlargement of the new stocks at later dates. It is considered that the method may have very considerable significance in counteracting the great mortality prevailing among the Djerোক Manis citrus.

170. WEATHERBY, L. S., AND SORBER, D. G. 634.653 : 581.162.3
Chemical composition of avocado seed.
Indust. Engin. Chemistry, 1931, 23 : 1421-3, bibl. 12.

Experiments by the authors on Mexican and Fuerte varieties lead them to the following conclusions: Avocado seed is made up largely of water, starch, sugar, protein, with but a small amount of crude fibre. It might possibly be used as a food or feeding stuff, which would probably necessitate the previous removal of the bitter-astringent principle. Perseitol might figure as a by-product, if a use for it could be found. Sixteen to eighteen per cent. material (moisture-free basis) including perseitol, tanning, pectic substances, gums, possibly glucosides, a bitter principle and other compounds remains to be determined quantitatively.

171. COIT, J. E. 634.653-2.181.2
Asphyxiation of avocado trees.
Calvado News, 1932, 6 : 1-2 : 16.

During heavy rains a number of fine avocado trees have been lost by the sudden wilting and drying up of foliage known as "asphyxiation." The trouble is in no way connected with cold injury, as is sometimes thought, but is due to sudden and usually temporary distress of the trees owing to lack of air in the soil. The symptoms are a strikingly sudden death of the leaves and small twigs, and a heavy fruit drop. This condition is brought about by the sudden shutting off of air from the lower roots, whereupon the lower intake roots slough off. The cause is usually to be found in the accumulation of free water in the surface soil, preventing the air from reaching the roots in the lower soil strata. Badly grown trees on an ill-drained subsoil are rarely affected, since they are forced to develop their roots near the surface. The sufferers are the vigorous deep rooted trees on the heavier soil types. Remedial measures consist in a prompt and heavy cutting back of the branches, white-washing the trunks and main branches against sunburn, and discontinuing irrigation until the new shoots are sufficiently advanced to be able to use the water. Within a year or two the tree will have resumed fruiting, but if similar soil conditions are not prevented from recurring further attacks are liable to occur.

TROPICAL CROPS.

172. RIPPERTON, J. C. 633.49 : 581.192
Physiochemical properties of edible canna and potato starches.
Hawaii Agr. Exp. Sta. bull. 63, 1931, pp. 48, bibl. 22.

The investigation described was undertaken to compare the differences of edible canna and potato starches and to study the causes of differences in the properties of starches of the same origin. New methods were successfully devised for the determination of differences in the swelling power, viscosity and hydrogen-ion concentration of the starches. A new method was employed for the preparation of the starch solution by the addition of hot water to a starch suspension in such a way as to make it possible to measure the swelling of the starch granules without stirring or

agitation and with a minimum of broken granules. Electrometric measurement of the starch suspension proved to be a satisfactory method. The effect of different neutral salts on swell and viscosity was proportionate to the valency of the cation, the greater the valency the greater the depression of swell and viscosity. Substitution of monovalent cations in the raw starches greatly increased the swell and viscosity. Bivalent and trivalent cations caused progressive decreases. Removal of the cations by acid and electrodialysis caused the granule to burst when cooked. Investigation of the causes of the differences in starches of the same kind showed that the starches of greatest swell and viscosity were unsaturated as to cations and had a low pH. Analysis of the electrolytes removed by electrodialysis and displacement with sodium chloride showed that the low viscosity starches contained appreciably more calcium than the high-viscosity starches. The possibility of preventing substitution of calcium in the starch granule either in process of manufacture or during growth of the plant is suggested. Difference in size of granules or in amount of broken granules was not found to be the cause of difference in viscosity in the starches used. Comparison of the properties of edible canna and potato starches showed that the latter is probably somewhat superior in swell and viscosity. Potato starch is characterized by decidedly larger amounts of cations and of phosphoric acid than in edible canna starch. In general properties the two starches are similar. [From author's summary.] The potato starches used were untreated commercial samples from the Netherlands, Germany and United States. The canna starches were prepared in the laboratory at the Experiment Station.

173. REDGROVE, H. S.

633.681

Arrowroot.*Food Manufacture*, 1932, 7 : 78-9.

Genuine arrowroot is the product of the rhizomes of certain *Maranta* species, in particular *M. arundinaceae* L., native of tropical America and the West Indies. Propagation is effected by cutting off and planting the upper ends of the tuberous rhizomes, since these portions containing little starch are not required for manufacture. The plants reach maturity in about ten months. A rich light soil and a moderate but not excessive rainfall meet their requirements. The flowers are removed as they form, with the idea of increasing the production of good tubers. At present St. Vincent B.W.I. has practically a monopoly of this product, exporting about 30,000 cwts. annually, chiefly to U.K., U.S.A. and Canada. In manufacture, the rhizomes, less the parts removed for replanting, are scraped clean of their outer fibrous covering, washed and pulped. The pulp is again washed in a current of water in a series of perforated trays. The starch is carried off by the water and is subsequently allowed to settle, the water is drained off and the starch dried. The methods used are primitive and the introduction of modern machinery is contemplated. [A loan of £30,000 and a grant of £3,000 has been provided for this purpose by the Colonial Development Committee and plant and warehouses have already been erected.—ED.] Arrowroot contains about 84% of starch, with quite minute quantities of protein, mineral matter and fibre, the balance being water. Fat is either absent or does not exceed two parts in 10,000. The ash contains phosphates, silicates and chlorides of calcium, potassium and iron. In the *Lancet*, August 10th, 1929, Dr. J. Campbell states that a series of commercial starches examined by him all gave an acid reaction with the exception of St. Vincent arrowroot, which was neutral. Arrowroot and potato starches have been found useful in feeding experiments, balancing a deficiency when rats are fed on dried protein, a property not possessed by cereal starches such as wheat, rice and maize.

174. EDEN, T.

633.72-1.55

Studies in the yield of tea. II.* The seasonal and sampling variation in yield and mineral composition of the tea leaf.*J. Agr. Science*, 1932, 22 : 386-95, bibl. 11.

The author, after discussing previous work, gives details of his own methods, and of the statistical procedure adopted and summarizes as follows : 1. Samples of tea leaf from different portions

* For I, see *ibidem*, 1931, 21 : 547 and H.A., 1931, 1 : 3 : 280.

of the same field were analysed for ash, nitrogen, potash and phosphate on thirty-five consecutive plucking rounds extending over a period of seventeen months, for which yields were also recorded. 2. The significant variations obtained are shown to be partly due to seasonal differences, which affect all the constituents, and to persistent differences between portions of the field in the case of yield, ash and potash. No significant differences were detected between the nitrogen and phosphate status of different portions of the field, although the sampling errors were not larger than those of the former category. 3. These results indicate that the sampling technique is satisfactory . . . and confirm the finding from other considerations that the standard of plucking can be maintained at a reasonably high level. 4. All the characters except ash show long-period fluctuations associated in a general way with the weather cycle. Nitrogen and yield were significantly and positively correlated, though not to a high degree. 5. Ash content exhibits fluctuations with a shorter period and was negatively correlated with rainfall.

175. LAMBERS, M. H. RIS. 633.73-1.521
 Vijf jaar selectiewerk op Soember Asin—Sept. 1926-Oct. 1931. (**Five years' selection work at Soember Asin.**) [Dutch-English summary.]
Med. Proefsta. Malang, **81**, 1932, pp. 42 (reprint from *Archief v. d. Koffiecultuur*, 1932, **6**, No. 1).

Selection of coffee has been made along the lines of increased production and decreased costs together with improvement of quality. Special efforts have been made to obtain varieties resistant to extremes of weather and other adverse conditions. The selection, reproduction and comparison of mother trees was carried out by grafting, by the sowing of self-fertilized seed and by comparison of grafts and seedlings from the same mother tree. Hybridization is given an important place and the methods of multiplying selected hybrids by grafting is fully described, while the possibility of reproduction by means of cuttings is not ignored. The danger of poor fructification owing to self-fertilization when large stands of any one grafted variety are planted is noted. The advantage of cuttings or layers over grafted plants is pointed out. It is not true that coffee plants raised from cuttings do not form tap-roots. Methods of effecting hybridization are described. When emasculating, almost the entire corolla with the stamens attached is removed and the branches wrapped round with a closely woven cotton impenetrable to pollen. Artificial cross fertilization gave even better results than natural fertilization, but the results from artificial self-fertilization were distinctly bad. It was not observed that the pollen of the father tree had any influence on the size of the endosperm in the seed. A fertilization of *C. arabica* Pasoemah by *C. Laurentii* resulted in an imperfect development of the endosperm of almost all the seeds. This abnormality has been observed in the seeds of Kawisari hybrids and in the seeds of already existing hybrids of *C. arabica* × *C. robusta*. A reciprocal crossing of two *robusta* numbers showed that vegetative divergences present in both parents became more pronounced. In analysing production figures there could be found no correlation between the production of the mother tree and its grafts. It is uncertain what part the influence of the grafting plays in this.

- 176. SLADDEN, G. E. 633.73-1.874
 L'emploi des engrais verts des plantes de couverture dans la culture de caféier.
 (**The use of green manures and cover crops in coffee cultivation.**)
Bull. Agricole du Congo Belge, 1931, **22**: 367-85, bibl. 15.

The need for green manures is taken as proved. The paper is concerned with a discussion of the most suitable crops, the conditions they must fulfil and methods of cultivation. Leguminous plants available as cover crops may be divided into two classes, erect and climbing. The erect varieties are sown in rows between the coffee bushes and for the first four years of a young coffee plantation provide the necessary shelter for the bushes, the permanent shade trees being not yet sufficiently large. In four years the coffee will in turn have so shaded the ground that the leguminous cover crop will die out. Thus it is never more than a temporary culture. The cover crop has to be kept under sufficient control to ensure that the young coffee is not smothered, and this control must be exercised early enough and often enough to avoid any such sudden changes of the environmental conditions as would be likely to upset the physiological balance of th

young coffee, such as, for instance, any abrupt transition from shade to sunlight, brought about by a too drastic cutting back of the cover. The ideal of digging in the clippings after trimming the cover crop is seldom attained. In practice they are generally left lying round the coffee bushes, preventing evaporation of soil moisture and the growth of weeds certainly, but also ensuring only imperfect assimilation of their manurial elements and providing a safe harbour for a variety of insect pests. A better plan is to open small trenches between the coffee bushes and bury the debris therein. In the dry season the cover plants should be kept close cropped to prevent undue competition for moisture with the coffee. Under normal conditions of moisture there is little danger of the coffee suffering, as the legumes are so much the deeper rooting. Climbing cover plants are seldom employed owing to the labour required to keep them away from the young coffee. Annual climbers such as *Calopogonium muconoides* have certain advantages in that they die down in the dry season, so that their dry residue screens the ground from the sun without competing with the young coffee for moisture. Quite often they re-sow themselves. A disadvantage is the danger of fire.

177. COCOA ASSOCIATION OF LONDON, LTD., AND OTHER. 633.74-2.7

Infestation of cocoa. Some practical measures for its prevention.

West India Committee Circular, 1931, 47 : 5-6.

In view of the serious amount of infestation of cocoa mainly due to the cocoa moth, *Ephestia elutella*, an endeavour is made to trace the main source of infestation and to suggest measures for its prevention. Directors of Agriculture in all cocoa producing countries sent valuable replies to a questionnaire circulated by the Committee, from which it was clear that a considerable infestation does take place in the Tropics, although the Directors point out the cocoa is not stored for any length of time before shipment. Visits were made to ships regularly engaged in carrying cocoa and as a result it can be concluded that steamships of the type visited are not responsible for any substantial increase in infestation. Visits to important London warehouses, however, showed that here there is a general need for improvement of conditions. Certain stores were badly infested, floors, walls and ceilings containing live pupae, while the quantity of moth in one warehouse was said to resemble a snowstorm. The Committee suggest certain essential measures which could be undertaken immediately at little cost and would result in a considerable reduction of infestation. Briefly these are : perfect cleanliness of floors of warehouses, yearly whitewashing of walls and ceilings, the tops of the bags to be brushed with wire brushes at the same time. There should be a supply of cool moving air circulating round the bag piles in summer and winter during the day time and sufficient illumination to see whether the store is clean. The floor area of individual stacks should not exceed 300 sq. ft. Stock arriving in the winter months should be stored on a separate floor.

178. DEINUM, H. 633.834

De nootmuskaatcultuur op de Banda-Eilanden. (Nutmeg culture in the Banda Islands.) [Dutch-English summary.]

Landbouw, 1931, 7 : 467-92, bibl. 5.

The methods of nutmeg cultivation in these small islands have remained unchanged for centuries. The island climate is moist, which is of advantage to the shallow rooting nutmeg, and the different soils of volcanic and coral origin are light in texture. A hindrance to economic cultivation is the fact that there are male, female and hermaphrodite trees and that these are indistinguishable from each other until about ten years after planting. For this reason it would be of the greatest advantage if an economically serviceable method of vegetative propagation could be discovered, apart from the benefits which would then be derived from selective propagation. At present fresh plants are raised from seed sown broadcast in seed beds. *Canarium commune* is used as a shelter and shade tree, but as regards shade to too great an extent ; the nutmegs themselves are planted far too closely and this has an adverse effect on production. The soil is untilled but in some " parks " there are occasional plantings of *Mimosa invisa*, as a green manure. Other kinds of manure are not used, unless the leaving of the husks to rot under the trees can be so regarded. In view of the fact that the nutmeg trees in Malacca in 1880 were

improved by the application of "natural" manure it is reasonable to conclude that the plantations here would also benefit. A mould spread through rain water has the effect of causing the fruits to open whilst still unripe, sometimes as much as 50% of the fruit being thus affected. More open planting and less shade are advocated to combat this disease. After gathering the nutmegs are very carefully but uneconomically treated, all work being hand done. It is suggested that much of the work could be done by mechanical means.

179. ANON.

633.85

The experimental cultivation of tung trees in the Empire.

Bull. Imperial Institute, 1932, 30: 24-35.

Chinese wood oil of commerce is obtained from two trees, *Aleurites Fordii*, Hemsl. and *A. montana* E. H. Wilson. *A. Fordii* supplies the tung oil, while the oil from *A. montana* is known as Mu-yu. The latter is stated to possess similar properties to tung oil, but this has not yet been definitely established, indeed investigations tend to show that it is somewhat inferior and takes a longer time to polymerize. It is unwise to allow the only source of commercial supplies of tung oil to remain as at present in China, and accordingly the possibilities of cultivation of the tree on a large scale is occupying the attention of the agriculturists in most countries where success seems at all possible. During the last four years the Royal Botanic Gardens, Kew, have distributed nearly 4 tons of *A. Fordii* and 700 lbs. of *A. montana* for trial in various parts of the Empire. Of the two *A. montana* requires a more tropical climate and a heavier hot weather rainfall. In the Southern Shan States 30 acres containing 2,100 plants were established by the Department of Agriculture in 1929 at an elevation of 4,650 ft. Most of these are growing well, though it is considered that they will not equal those in the possession of the Tung Oil Estates Ltd., in the Northern Shan States. Here the elevation is lower and the soil, well drained and porous, seems more suitable. This Company has planted 750 acres and is planting an equal area this year. In Burma small experimental sowings of *A. Fordii* produced trees of 4 ft. in two years. In Assam Mr. D. S. Withers has fruited trees within two years of sowing and now has an area of 100 acres planted with *A. Fordii*. He thinks it possible that *A. montana* may be a more suitable tree in parts of Assam where the annual rainfall exceeds 60 inches. In Ceylon repeated trials have shown that *A. Fordii* will not flourish though *A. montana* appears to do well. The Malayan Agricultural Department advise that both species are unsuitable for cultivation on the plains, though trial plantings are still under observation in the hills at 5,000 ft. In Australia a company has been formed to establish a 1,000 acre plantation near Sydney. A sample of oil from Australian grown trees was pronounced by the Imperial Institute to contain a normal percentage of oil of very similar composition to the Chinese product. In New Zealand plants have been raised without difficulty and growth appears to be good. Five public companies with a total nominal capital of £780,000 have been formed to develop the cultivation of this product in the North Island. Experimental trials are in progress in all British countries in South and East Africa. At present results are indefinite and not particularly encouraging. It appears to be essential to success that *A. Fordii* should have a definite resting period induced by a cold season. Outside the Empire many countries are experimenting, the most important trials being in the Argentine, where round San José and Pindapay in Misiones there are some 50,000 trees. In Paraguay there are 30,000 trees. In conclusion it is suggested that until tung oil can be proved capable of being successfully and profitably produced in any particular district—and this must necessarily take some years to establish—large scale plantings should not be undertaken nor should the public be invited to subscribe funds.

180. GEORGI, C. D. V., AND OTHERS.

633.88(59.5)

Hydnocarpus oils in Malaya.

Dept. Agr. S.S. and F.M.S. scientific series, 9, 1932, pp. 18, bibl. 4.

A report on the oils of *Hydnocarpus anthelmintica* Pierre and *H. Wightiana* Blume from the fruit of trees growing at the Government Experimental Plantation, Serdang. The oil content of the seed of *H. Wightiana* proved to be double that of *H. anthelmintica*. The seeds must be cleaned and dried as soon as the fruit has fallen. Delay leads to the production of an inferior quality of

oil. Both oils contain a large proportion of hydnocarpic acid, the mixed ester in both cases containing between 60% and 65% of hydnocarpic ester. It appears that *H. Wightiana* would be the most profitable source of pure hydnocarpic oil, since the contaminating esters, i.e. those other than hydnocarpic and chaulmoogric, are found associated with the latter ester, thus leaving the hydnocarpic ester relatively pure. In *H. anthelmintica* the reverse is the case. Extraneous acids other than hydnocarpic and chaulmoogric are less in oil from *H. Wightiana* than in that from *H. anthelmintica*.

181. WILLE, J. 633.88.781.6-2.7
Der Coca-strauch Perus und seine Schädlinge. (Coca in Peru and its pests.)
Tropenpflanzer, 1932, 35 : 9-25, 47-64, bibl. 12.

The writer, who last year in the same journal gave an account of the cultivation and trade in Peruvian coca,* here recapitulates the main points in that article and then proceeds to deal with the chief pests and their control, stating that this is the first modern account of these pests. Certain larvae of the *Danaidae* and *Lasiocampidae* are occasionally found to do damage, but this has not so far been serious. The leaf cutting ant *Acromyrmex hispidus* Santschi is an important pest only in young plantations, but the two lepidopterous insects *Eloria* (*Penora*) *noyesi* and *Eucleodora cocae* are definitely of the greatest economic importance. Of these very full accounts are given, including name, systematic place, food plants, geographical spread of incidence and of damage, morphology of the egg, larva, pupa and adult, biology and ecology, damage caused and economic importance, and finally suggestions for control.

182. HAINES, W. B., AND FLINT, C. F. 633.912-1.8
The manuring of rubber. III. Résumé of present position.
J. Rubber Research Inst. Malaya, 1931, 3 : 57-93, bibl. 9.

The paper deals with the general manuring of Hevea, exploring the possibilities of yield improvement based upon the correction of poor nutrition in its effects on age of maturity, foliage and bark renewal. The chief features presented by rubber estates to justify the application of manure are first examined. It is noted that even the heaviest crop of rubber will take from the soil only a fraction of that removed by an annual crop such as wheat. The reserves of organic matter in tropical soils are quickly exhausted especially after forest clearance, this exhaustion not being readily apparent to the eye although it will have prolonged effects. It is essential to know the planting history of an estate after clearing, since it is estimated that three successive crops of tapioca covering a period of four or five years would remove from the soil as much nitrogen, phosphoric acid and potash as would be consumed by rubber in 25, 10, and 20 years respectively. Trees in need of manure fall into two classes linked by imperceptible gradations ; those satisfactory at first showing gradual deterioration and those which have done poorly from the start. Deterioration can generally be attributable to nitrogen deficiency or nitrogen starvation due to unavailability of the supplies in the soil. In trees stunted since planting on a poor soil potash and phosphate may sometimes be needed. Mineral deficiencies should be remedied in early life, good results with phosphates, for instance, being often obtained with young rubber but seldom with mature rubber. Mature rubber seeming to need manure should be given a straight dose of nitrogen for a start. Cases of manurial experiments in Sumatra, Java and Malaya are summarized. The proportion of uncertain results indicate that an increased yield from any manuring programme cannot be guaranteed, but that if certain rules are adhered to, chances of success are greatly improved. The yield level should be low. Increases of yield from trees producing over 400 lbs. per annum are rare. With yields of 200-300 lbs. increases are common. Response is most readily obtained from trees of good appearance and poor yield. Experiments should not be discontinued if results are slow, observations over a period of seven years being advisable. Cases of thin and slow bark renewal are sometimes found in trees of strong vegetative vigour growing on flat alluvial land when compared with similar plantings on other soil types. Here the soil deficiency is clearly not one of nitrogen and the phenomenon

* *Tropenpflanzer*, 1931, 34 : 90-109 and H.A., 1931, 1 : 2 : 187.

is still in need of investigation. The article concludes with the statement that the future of rubber cultivation will be along forestry lines where the nitrogen supply of the soil is automatically regulated by the environmental conditions (see H. A., 1932, 2 : 1 : 75) and that a change to this system is about to take place.

183. BISHOP, R. O. 633.912 : 678.135

Plantation sheet rubber manufacture.

Rubber Research Inst. of Malaya, Planting Manual 3, 1932, pp. 61, figs. 29.

This manual embodies the latest information concerning improvements in estate factory practice in the coagulation of latex, the handling of coagulum, machining, drying and smoking of sheet rubber. The information is well supported by illustrations and line drawings. Throughout the work it is emphasized how the various stages in manufacture are connected and how inefficiency in one operation may affect the unity of the whole process.

184. NAPPER, R. P. N. 633.912-2.952

A further note on the effects of fungicides on the viability of Hevea buds.

J. Rubber Research Inst., 1931, 3 : 114-9.

Budwood from clone Avros 50 disinfected with 5% and 2% solutions of copper sulphate and sent to Ceylon suffered much more severely from the effects of the disinfectant than did budwood from a local clone G.771 sent from Ceylon to Malaya. These results are probably due to differing degrees of susceptibility between clones, and, should regulations for the disinfection for imported budwood or budded stumps become more exacting, an investigation into relative susceptibilities of popular clones will have to be undertaken.

185. ANON. 633.912(47)

The Soviet's rubber growing plans.

India-Rubber J., 1932, 83 : 9 : 10.

It is announced by the Soviet's Berlin Trade Mission that the second "Five Years' Plan" of development of Russian resources provides for a large expenditure on the cultivation of native rubber-yielding plants. Chief among these is the Tan-sagys, identified by the United States Dept. of Agriculture as a species of *Scorzonera*. The whole plan provides for the cultivation of about 1,408,500 acres of this plant, and a smaller acreage of certain other rubber yielding plants. Nine factories are to be erected and the yield to be dealt with is estimated at 20,000 tons in 1935 rising to 85,000 tons in 1937. Reports, not very clearly expressed, of the yield of this *Scorzonera*, are interpreted by Mr. G. H. Carnaban of the Intercontinental Rubber Company, to indicate that the rubber recovered from the latex contains 95% of pure caoutchouc, which would make it a very high grade product, since commercial plantation Heveas of the best class contain only 92-94% caoutchouc. Tan-sagys is being cultivated in very different climates including those of central Asia and the country round Moscow. It is very easily propagated either by seed or root cuttings. Even the smallest piece of root left in the ground when transplanting will produce a new plant.

186. BOBILIOFF, W. 633.912 : 581.1

Anatomie en Physiologie van Hevea brasiliensis. (Anatomy and physiology of H. brasiliensis.)

Uitgave van het Physiologiefonds te Buitenzorg. Ruygrok-Batavia, 1930, pp. 288, bibl. numerous.

A resume of articles appearing in Mededeelingen 1-32 (1918-25) of the Archief voor de Rubber-cultuur. The book is intended especially for the planter. The first part deals with the anatomy of the plant. The Ashplant theories on selection methods are discussed but not accepted. The author next deals with the physiology of latex. He defines chyle, considers its composition in Hevea and other plants, and pays attention to the relationship between latex and water balance of plants and between these and metabolism. In his final chapter research data are discussed

and the following points touched on : the function of chyle vessels as storage organs for minerals and as a water reservoir ; the conduction of materials in the chyle vessels ; the loose combination of oxygen by latex and the nutritional physiological importance of chyle. He regards rubber as a plant excretion product analogous to resins, arising as the final produce of intramolecular respiration of Hevea. In this process levuline aldehyde is formed, which passes by reduction and condensation into rubber. [Trans. from review in *Tropenpflanzer*, January, 1932, vol. 35, No. 1.—Ed.]

187. DECARY, R. 634/5(69.1)
Nouvelles cultures entreprises dans l'Extrême Sud de Madagascar. (Trial of
new crops in the extreme south of Madagascar.)
Rev. Bot. Appl., 1932, 12 : 195-7.

Economic conditions have made it necessary to introduce a new fodder plant to replace the spiny *Opuntia* destroyed by the cochineal insect and also additional varieties of plants suitable for food for the inhabitants, since the local crops of potatoes, manioc, sorghum, etc., are easily unfavourably influenced by a too short or late-starting rainy season. The haricot Téparé (*Phaseolus acutifolius* Gray) seems to be very suitable. It is grown in Arizona on a large scale under semi-arid conditions. No other haricot can succeed on so little moisture, and it is a prolific bearer. First trials in south and west Madagascar have produced highly favourable results. The question of a new fodder plant has been resolved by the propagation of *Opuntia stricta* Haw, a spineless cactus lately retrieved from certain isolated villages, where it had been introduced years ago and forgotten. The cattle though preferring the spiny *Opuntia* will soon become used to this substitute.

Leucaena glauca is another fodder plant which was kept in the background while the prickly pear was plentiful. Now that this is gone, *Leucaena* is to be propagated as a substitute.

188. PERRY, EDITH O. V., AND ZILVA, S. S. 634.441 : 577.16
Preliminary report of the vitamin content of the mango.
Empire Marketing Board publication, 1932, pp. 24, bibl. 8.

Of the three varieties of mangoes tested the pulp of Alphonso was found to be one of the most potent sources of vitamin C, while its rind contained at least as much. The variety Cawasji Patel is slightly less active but is as potent as the previously best known anti-scorbutic source. The remaining variety, Shendrya, contains in comparison little vitamin C. Vitamin A is possessed by all three varieties in similar quantities to that of butter, Alphonso being again slightly superior. Vitamin D was not found in significant quantity in any of the three sorts examined.

189. CHEVALIER, A. 634.58(66.3)
La culture de l'arachide au Sénégal. (The cultivation of the groundnut in
Senegal.)
Bull. Matières Grasses, 1931, 15 : 199-210.

Senegal possesses the most suitable climate conditions in the world for the cultivation of groundnuts. There they take but three to three and a half months to arrive at maturity. In their cultivation owing to the dry heat methods of soil moisture conservation are considered of more importance than manures. Eight varieties are cultivated by the natives, each one seeming to be especially adapted to its own particular region. All of them are of prostrate habit, but among them are always to be found scattered individuals of erect growth and, since an erect habit is essential to permit of mechanical cultivation, it is these varieties that should form the basis of future attempts to improve the race. The use of chemical manures is but little understood nor is there an agreed opinion on what is most suitable for the crop. The yield, usually from 600-1,000 kgs. per hectare, is strongly influenced by climatic conditions and varies from year to year. It is undoubtedly amenable to improvement through improved cultural methods and varietal selection. Insect pests claim at least 15-20% of the crop. Methods of control exist in other

countries and could be, but are not, applied here. A virus disease, "la rosette," akin to the mosaic of sugar cane is the cause of much loss. The cure seems to lie in the cultivation only of immune varieties if such can be found. Weeds also help to reduce the crop. The extension of the cultivation of groundnut is governed not by the area that can be sown but by the area that can be kept clean. The appearance of certain weeds such as the Ndatoukan (*Spermacoce Ruelliae*) signifies to the natives that the land will no longer profitably produce the crop and these fields are then left fallow for several years. Trees allowed to remain on the ground occupied by the crop are also inimical to its proper development but it is not proposed that these should be removed until shelter belts are established and forest reserves created. The article concludes with suggestions for suitable alternative crops and the plea that the native should be induced to abandon the primitive methods of his ancestors and avail himself of the new discoveries in tropical agriculture.

190. ODELL, F. D.

634.58(59.17)

Groundnut in Burma.*Agricultural Survey, Burma Dept. Agr. No. 11 of 1931, pp. 11.*

A description of the cultural methods of Upper Burma is given. Trials by the Agricultural Department have been in progress for a number of years with a view to selection of varieties combining high yield with maximum oil content. In these tests the influence of environment was apparent both in yield and oil content, so that only varieties from the same plot, with the same sowing date, have been used in comparison. Among the erect varieties Imperial Spanish, Bombay Small Japanese and Bombay Small Spanish, are inferior to local Small Japanese and Small Spanish. Of the two the oil from Small Spanish is lighter and preferred by oil pressers. Among the spreading type Mauritius has shown itself consistently the highest yielder in the field and has also the highest percentage of oil for the whole nut. Pondicherry and Burmese come second without distinction between them. Comparison between erect and spreading varieties is not possible. The erect type gives on compact soils the higher yield owing to greater ease of harvesting, but on loose soils which are normal to the groundnut it is definitely inferior to the spreading type. In oil content there appears to be no significant difference between the two.

191. CHEVALIER, A.

634.6

Nouvelles recherches sur les palmiers du genre *Raphia*. (Further investigations on the palms of the genus *Raphia*.)*Rev. Bot. Appl.*, 1932, 12 : 93-104, 198-213, bibl. 4.

Raphia palms are not yet cultivated on a commercial scale, if one can exclude occasional plantings by the natives of Madagascar and parts of Tropical Africa, for domestic purposes, the natives of Dahomey in particular having well kept plantations. Even under these conditions horticultural varieties have come into being. To put the cultivation of *raphia* on a commercial basis it will be necessary to institute organized research similar to that done in the case of the oil palm. Ecologically the *raphia* is a plant of moist peatlands. In their primitive states they margin the edges of swamps, ponds and watercourses, often in miry sites which are periodically subject to inundation. Seeds from the great numbers of fallen fruits germinate freely in the mud and soon the ground is covered with pure stands of the young palms from whose dense mass comparatively few emerge to reach maturity. On the return of the water the subterranean roots of the palms emit a quantity of pneumatophores. *Raphia* populations are generally transitory ; they occupy the gradually drying marshes, as, for instance, in the rear of a mangrove formation, and prepare the way for the mixed tropical forest. Here their survivors may linger as isolated specimens, usually near depressions which collect seasonal water. *Raphia Ruffia* (Jacq.) Mart. [= *R. pedunculata* Beauve.—Ed.] is only found wild in the marshlands in the North-west of Madagascar, but it has spread through cultivation and is now partly naturalized in other parts of the island, even in districts subject to a prolonged dry season. *Raphia gracilis* Becc. is found in some quantity in Lower Guinea and extends to Senegal. The sites on which it grows are considered to

form good banana land ; to prepare this the thickly growing young palms are cut down and burnt and the stumps are buried in the ground, which is dug to the depth of a metre. Thus treated the soil quickly loses its acidity. *Raphia Hookeri* Mann & Wendl. extends round the Gulf of Guinea from Gabon to Sierra Leone, its maximum development being along the Ivory Coast, on the edges of lagoons beyond the mangrove swamps. This is the variety cultivated in Dahomey for palm wine and raphia fibre. A number of other raphias are described. The general uses of the raphias are as follow : The sap, obtained by incisions in the growing tree, fermented becomes palm wine or toddy, evaporated gives a sugar. The petioles and leaf ribs are used in joinery and building, the leaves as hut thatches. The leaflets interlaced or plaited are made into bags, mats or fencing ; the leaves after retting give the raphia used in horticulture, or mixed with cotton are woven into native garments ; hats are fashioned out of the epidermis of the petiole. The above are but a few of the uses to which the palm is capable of being put. It is suggested that the vegetable oil produced by the fruits would, if the trees were submitted to proper cultivation, rival that produced by the oil palm (*Elaeis*). It is remarkable that a plant capable of so many adaptations is not more extensively cultivated.

192. JACK, H. W., AND JAGOE, R. B.
Variation in fruiting ability of oil palms.
Malayan Agr. J., 1932, 20 : 14-9, bibl. 9.

634.6 : 581.162.3

A comparison between palms artificially pollinated and those left to pollination by natural means, both series growing in the same avenue, resulted in three successive years in the artificially pollinated palms producing about five times as much fruit as those naturally pollinated. Marked individual variation of yield was shown. A subsequent investigation of 509 palms, growing under ordinary plantation conditions, disclosed a co-efficient of variability for naturally pollinated palms of 49%. 25% of the total population produced only 11% of the total crop, while at the other extreme 30% of the palms produced 48% of the crop. Thus there appears scope for selection among the better yielding palms, since it appears from authenticated fruiting records extending over five years that good yielding palms constantly produce good crops. Unfortunately the only way of distinguishing the inherently high yielders from those which have merely responded to a favourable environment is by a study of their progeny yields, and to achieve this the slow method of propagation by seed is the only one available. This work is now being undertaken by the Department of Agriculture.

193. PARK, M.
The effects of drought on coconuts at Puttalam.
Trop. Agriculturist, 1932, 78 : 11-4, bibl. 1.

634.61-2.112

A heavy and sudden mortality among coconuts at Puttalam, Ceylon, was investigated. The symptoms were those of a wilt and closely correspond to what is known as Bronze Leaf Wilt in Trinidad. The leaves gradually turn brown and wither and finally the young crown breaks off just at the level of the bend. If left these crowns become a nursery for the rapid propagation of the coconut beetle (*Oryctes rhinoceros*). No trace of fungus disease was observable and the outbreak is attributed to physiological causes due to a drought, which had been severe for some months. That the disease is worse in low lying land waterlogged in wet weather can be explained by the fact that with a high water table the effective root system of the coconut is confined to the upper layers of the soil, which are the first to dry. Possibly also the soil where water is allowed to stagnate acquires an excessive salinity when dry and thus may contribute to the marked effect of drought on palms growing in such soil. Increased drought resistance can be obtained by cultivation ; the land should be drained to encourage deeper rooting and weeds should be ploughed in at the beginning of the dry season to increase the humus content of the soil and reduce competition for the water supply. Palms whose bud tissues have decayed will never recover and must (by law) be cut down and burned. Those whose bud tissues are still sound will resume growth with the rains and be little the worse.

194. SURRIDGE, H. R., AND OTHERS. 634.61(96.1)
The improvement of Fiji copra.
Fiji Agr. J., 1931, 4 : 89-126, bibl. 10.

A report giving a detailed account of " investigations primarily directed to the study of possible simple methods for adoption by small producers in the Colony of Fiji, having for their object the prevention of rapid deterioration of copra by mould attack." Working plans are supplied for the construction of a sulphuring chamber. The Imperial Institute reported on the samples of copra prepared by the various methods tested and here described and a summary of this report is given. It is considered that the information contained in this paper should be of value to workers in other parts of the world where similar problems have to be dealt with.

195. LEGROS, J. 634.62(65)
Date palm growing in Southern Algeria.
Int. Rev. Agr., 1932, 23 : 82-9 T., bibl. 13.

A summary of a series of reports on the cultivation of the date palm, which were presented during Date Palm Week organized at Biskra in November, 1931, by the Algerian State Railways, the Departments of Agriculture and the Department of the Southern Territories. Among the points touched on are varieties of dates and the localities to which each is most suited ; rational management of a date palm plantation ; deep ploughing and, in certain heavy soils, subsoiling by means of explosives, it being noted that chlorate explosives, however, are toxic to the plant. The kind of chemical manures most suitable to oasis conditions is discussed, with particular reference to those to be used in salty grounds which occur usually where water is most available. Methods of removing the salt from the ground are described, the most rapid being by abundant leaching. Farmyard manure spread between the rows of trees is a good antidote to marine salt. There is an interesting section on the somewhat complicated local processes of irrigation and drainage, of which almost each oasis has its own variation. Associated crops, apart from green manures, which will succeed under the palms are various citrus varieties (but not apricots, peaches, plums or figs, which are only profitable on the outskirts of the plantations), many vegetables, including all the cruciferous varieties, tomatoes, egg plants and cucurbitaceae. Fodder crops for this position are Temacine lucerne and Alexandria clover. Experiments are now being made with cotton. Pollination. The choice of pollen is important, supplies are often kept over from one year to the next to ensure it being available when required, though fresh pollen is used if possible. The pollen parent should be of similar type to the female tree and the operation performed on a warm calm day or the dates will be of no commercial value. Thinning is practised as soon as the fruit is set, bunches at the heart which use too much sap and late bunches being selected for removal. Three to twelve bunches are left according to the vigour of the tree. An experiment is being carried out at Ain-ben-Noni to determine whether regular ripening can be obtained by surrounding the bunches with cellophane bags of different colours.

196. KERVÉGANT, D. 634.771/3(72.9)
Le bananier à Martinique. (The banana in Martinique.)
L' Agronomie Coloniale, 1931, No. 168, pp. 161-7, 1932, No. 169, pp. 6-12,
 No. 170, pp. 44-8.

In view of the precarious condition of the sugar cane plantations in Martinique the author suggests the possibility of a great extension of banana growing. At present its cultivation is largely in the hands of small proprietors and its organization has been spasmodic and ineffectual. Three species are represented on the island each with many varieties. *Musa paradisiaca*, of which the most commonly grown varieties are the Corne, Créole and Blanche. *Musa sapientum*, whose fruits are commonly known in Martinique as " Figes," contain six varieties of which Makanguia = Gros Michel - Martinique would be the ideal variety for export, were it not so very exacting in its soil requirements, highly susceptible to diseases and pests and, by reason of its height, to wind. *Musa nana* Lour = *M. Cavendishii* = *M. chinensis* Sweet, including the Petite naine and the Grande naine varieties. By reason of their hardiness and yield these two varieties

alone have so far been grown for export in Martinique. Notes are given on the best cultural practice, on packing and on the incidence of pests and diseases. The most important pests at Martinique are *Sphenophorus sordidus* and *S. liratus*. Naine varieties are much less damaged by these than the Makanguia. Other insects doing less serious damage are *Thrips* sp., *Aleyrodicus cocois* and other *Aleyrodides*, *Aspidiotus destructor*, *Vinsonia stellifera*, *Lecanium hemisphaericum*. Panama disease, *Fusarium cubense*, though present in a few Makanguia plantations, is only widespread enough to prevent any extension of the cultivation of this variety. *Lasiodiplodia Theobromae* has been noted on an old cocoa site and is found causing rotting of the rachis and of gathered fruits, as are also *Thielaviopsis paradoxa* and *Gloeosporium musarum*.

197. CHEESMAN, E. E.
Gros Michel and Pisang Embun.
Trop. Agriculture, 1932, 9 : 87.

634.772

The suspicion that the Gros Michel banana of the West Indies was synonymous with the Pisang Embun of Malaya, voiced by several writers but denied by others, has been confirmed by the importation of suckers of Pisang Embun into Trinidad, after the usual quarantine period at Kew. The plants were grown alternately in a row with Gros Michel and no smallest difference was discernible in plants, inflorescences or fruits. Furthermore when a plant of each contracted Panama disease the progress of the symptoms ran parallel in the two cases proving the susceptibility to be substantially the same. The somatic chromosomes in both varieties number 33. Since there is another Malayan banana with a somewhat similar name whose fruit ripens green it is emphasized that this identification concerns only the true Pisang Embun of Malaya with fruit that ripens yellow.

198. LECKIE, W. G.
The growing of wattle and production of wattle bark in Kenya.
Kenya Dept. Agr. bull. 1 of 1932, pp. 12.

634.973.737(67.62)

Acacia mollissima is the main source of tannin in Kenya. It prefers deep red chocolate soils and a rainfall of from 30-60 inches. A rainfall of under 30 inches results in slow growth and if it is over 60 inches the bark becomes covered with lichen. A plantation of black wattle is a valuable soil renovator and it is so used by the natives for restoring the humus content of their worn-out maize lands. The seed, after a preliminary soaking in water which has been brought to boiling point, is broadcast at the rate of 6-10 lbs. to the acre, or sown in drills 3-4 ft. apart or at stake at the rate of 1-2 lbs. an acre. Two cultivations per year are given for the first two years, after which a canopy is formed and the weeds are smothered. Thinning is done when the plants are 12 inches high, and again at $2\frac{1}{2}$ -3 $\frac{1}{2}$ years, resulting in a final stand spaced 12 ft. by 6 ft. With the rapid growth caused by this wide spacing it becomes economical to strip the trees at from 5 to 6 years old. The poles from the thinning find a fair market as drop posts for fencing, etc. Strippings from the mature trees should not be mixed with strippings from the thinnings since the thickness of the bark, provided it is not due to cork, is taken by the trade as an indication of maturity. Since the thicker the bark the higher the tannin content, it is customary first to strip the standing tree of the more valuable bark at the foot of the tree to a height of 3 ft. from the ground. The tree is then cut down and the remainder of trunk and branches stripped, any under $2\frac{1}{2}$ inches in diameter being disregarded. The best returns are usually obtained from the sale of green bark, as on drying it loses 48% of its weight. In railing to the factory wooden trucks must be used, otherwise the bark sweats and spoils. Drying is the most important of all operations, improper methods having in the past led to much loss. The stripped green bark should be spread out in thin layers, off the ground, or chopped into small pieces about 2 inches long. In places where dry weather cannot be expected at the time of bark stripping, drying sheds open at the sides should be erected, and the bark strips hung on poles inside. If a system of overhead rails can be erected so that the poles can be run in and out of the sheds according to weather, the bark will dry very much more quickly and smaller sheds can be used. Plantations can be cropped for at least four rotations without manuring the land. Regeneration of plantations may be effected by laying loppings from the previous crop in rows on the old stumps and

setting fire to them immediately before the rains. Seed dropped from the old trees will germinate along the lines of the burnt brushwood. Finding a market for the wood is not easy, since the wood is not durable enough for building any but very temporary structures. The Imperial Institute reports that it is suitable for the cheaper grades of wrapping paper. Charcoal burning would form another method of disposal, an acre of mature wattle yielding $7\frac{1}{2}$ tons of charcoal.

STORAGE.

199. EMPIRE MARKETING BOARD. 634.1/7 : 656.61(94 + 931)
Australian and New Zealand fruit shipments.
Empire Marketing Board, 46, 1931, pp. 68, bibl. 21.

A report of an investigation by the economic section of the Empire Marketing Board into the deterioration in transit of imported Australian and New Zealand fruit, 1927-30. The wastage was in general due in apples, to over-ripeness and fungal rotting, internal breakdown and bitter pit, in pears to over-ripeness. With the exception of bitter pit these deteriorations can be associated with temperature conditions of the hold during shipment. Maintenance of uniform optimum temperatures is, however, a matter of extreme difficulty. Bitter pit is more extensive in early than in late picked apples, but while delayed harvesting might effect a considerable reduction in the extent of the pitting in varieties such as Sturmer Pippin and Cleopatra, which are generally picked when too immature, the very susceptible varieties Cox's Orange Pippin and Ribston Pippin often arrive in so forward a condition that later picking would be attended with grave risk. A large measure of control might be obtained by suitable methods of storage, but the optimum conditions have not yet been determined with certainty. Internal breakdown in New Zealand apples has been shown to be of the form associated with low temperature. In the present survey both in the case of New Zealand and Australian apples the injury was found at the time of unloading to be most extensive in the maturest apples. This suggests a breakdown in connection with advanced maturity in addition to the low temperature type. Further investigation is needed before effective control measures can be put into force. The relationship between size and wastage is well established, the largest apples being so susceptible that their export can scarcely be profitable, besides adversely affecting the reputation of all fruit from the exporting country. It is a matter for consideration whether this export of very large apples should not be prohibited. Scald and core breakdown, generally in association, is often very pronounced in Australian pears. Control measures have not yet been established and investigations in Australia are very necessary. Delay occurring between the time of unloading and the time the fruit reaches the retail shops is responsible for much wastage. It is urged that the importance of rapid marketing cannot be over emphasized.

200. CARNE, W. M. 634.11-1.564(94)
The export of Australian apples. Suggested improvements of present methods.
J. Council of Scientific and Industrial Research, Aust., 1932, 5 : 40-6. Re-printed in *Fruit World of Australasia*, 1932, 33 : 143-6.

The criticism made of Australian apples on their arrival in Europe is that of variability and unreliability. The quality of the fruit is no worse and in some cases better than that of its competitors from other countries, but the grading is irregular or unstandardized, the packing is sometimes loose and sometimes excellent, there are too many brands or marks, a multiplicity of small lines and far too many varieties. The result is that the prices received are variable and show a much greater range between highest and lowest than those received by other countries in the same market. These facts have set up a reputation which reacts unfavourably on good fruit. The causes of this state of affairs are attributed to : (1) the present export regulations and their application, (2) inadequate organization for better handling, shipment and marketing, (3) lack of appreciation of the importance of details for overseas marketing. Turning to points of detail the author refers to the need of picking at the correct time, neither too early nor too late ;

the best practical guide for picking is the ground colour of the fruits, the proportion of yellow to green proving an effective indicator if used intelligently. Quick maturing varieties subject to watercore should be picked with a view to avoiding it. On the approach of picking time samples of the larger fruit should be opened daily as being the first to develop watercore. Picking of the main crop should be completed as soon as or before watercore is found. In light crops watercore appears earlier and the best picking stage is when faint signs of yellow appear in the green. The remainder of the paper is taken up with instructions in the proper methods of grading, packing and labelling for export.

201. TINDALE, G. B. 664.85.11.037
Cool storage investigations with particular reference to the influence of the maturity of apples at picking time on cool storage qualities.
J. Dept. Agr. Victoria (Aust.), 1932, 30 : 95-104, bibl. 9.

Details are given of experiments to determine the effect of maturity at time of harvest on the storage diseases, bitter pit in Cleopatras and Jonathans, and breakdown, soft scald and spot in Jonathans. The apples used were taken from individual trees growing under a wide range of soil and climate. They were picked at fortnightly intervals and examined for maturity by means of a colour chart. They were stored without delay and examined for disease six months later. The results fail to support the theory that bitter pit is produced by picking apples before they are sufficiently mature. In fact the results with all the diseases indicate that their occurrence can be related more clearly to the fact that susceptible fruit was borne on particular trees. Experimental watering treatments produced striking effects in pit development, continuous watering resulting in a high percentage of tree pitting. A high correlation was shown to exist between tree pitting and store pitting. Maturity at picking may with some apples have a modifying influence on the incidence of bitter pit as it has on other storage diseases, but it is concluded that external environmental conditions in the orchard and conditions inherent in the tree itself are of paramount importance in their reactions on the physiological state of the apples. What these conditions are is as yet uncertain.

202. TROUT, S. A. 664.85.13
Experiments on the storage of pears in artificial atmospheres. II.* Subnormal oxygen atmospheres with and without the addition of carbon dioxide.
J. Pom. Hort. Sci., 1932, 10 : 27-34, bibl. 8.

The experiments were on Doyenne du Comice pears, which were stored for periods up to 84 days at a temperature of 3° C. (37·4° F.), and were ripened in air at 10° C. (50° F.). In storage the oxygen concentration of the atmosphere was varied from normal, i.e. 21%, to 6% to 2% to 0·2% in conjunction with varying percentages of carbon dioxide from 0-20%. The effect of the addition of carbon dioxide in the case of all concentrations of oxygen above 2% was the same. A marked retardation of ripening occurred and a pronounced after-effect of slower ripening in air. All the carbon dioxide treatments affected the flavour, but there was no visible injury external or internal. The author warns against drawing any general conclusions from this particular instance, except that atmospheric control as an adjunct to refrigeration in the storage of pears has definite possibilities.

203. MRAK, E. M., AND HENDRIQUES, V. 664.85.25.035
Trial shipment of barrelled peaches to Germany.
Fruit Products J., 1932, 11 : 142-3.

The tariff on canned goods shipped into Germany is high, whereas on barrelled fruit it is relatively low. Barrelled peaches preserved in SO₂ solutions shipped to Germany reached their destination in good condition except for softening. The softening of peaches preserved in an SO₂ solution was found to be dependent on the concentration of SO₂ solution used. Because of the interest of this work in California and Europe it will be continued another year. [Author's summary.]

* For I, see *ibidem*, 1930, 8 : 78 and H.A., 1931, 1 : 1 : 103.

The two types of solution used were (1) 6% sulphurous acid diluted with water to a strength of .34%-.41% or 3,400 parts per million to 4,100 parts per million of SO_2 and (2) a solution prepared by adding 26 fluid oz. of 90% formic acid solution to a 50 gallon barrel, which equals approximately .4%, calculated on the total weight of 50 gallons of water and the assumption that the specific gravity of formic acid solution = 1.

204. COOK, F. C.

634.61-1.563

The storage of coconuts after harvesting.

Malayan Agr. J., 1932, 20 : 5-13.

The excellence of Ceylon copra enables it to command a premium of 75 cents a picul over Straits No. 1 copra. In an attempt to raise the standard of Malayan copra Ceylon methods of production were studied. This paper deals with the Ceylon practice of picking and storing green coconuts before manufacturing the copra. It is decided, however, that the system is not to be generally recommended for Malaya. Owing to local conditions Ceylon coconuts generally fall in a greenish condition or are picked when still green. They are then collected and transported unbroken and placed in a depot consisting of a heap 3 ft. high which often covers a very extensive area. The storage period usually lasts one month. By keeping the depot always stocked the copra can be dried at a constant rate irrespective of crop fluctuations, fewer or smaller kilns are required and the labour is constantly employed, while, should the price rise, additional copra can be put on the market. Regular collection is the rule, since too immature nuts spoil with storage and ripe nuts germinate. These methods ensure a uniform raw material which produces a uniform quantity of copra. In Ceylon the extra cost of storage represents an additional charge of 56 cents a picul, against which must be set off the facts that stored nuts can be husked four times as quickly as unstored and the regular working of the kilns will certainly produce an added efficiency among the attendants. In Malaya it is considered that the reduced copra yields resulting from using green nuts would not be sufficiently compensated by an increase in quality, hence the continued use of brown, ripe coconuts without storage is advocated, but in cases where green nuts are unavoidably included in the crop (as on native holdings) one month's storage of the green nuts is advised.

205. NYENHUIS, E. M.

664.85.651

Experiments with "export" of papaws.

Farming in S. Africa, 1932, 6 : 499-500.

Investigations into the keeping qualities of papaws and into the most suitable temperatures were undertaken by the Horticultural Section of the Dept. of Agriculture in collaboration with the Low Temperature Research Station of the Division of Plant Industry at the request of growers. Several types of the fruit were stored at temperatures of 45° F., 40° F., and 36° F. After 21 days in cool storage the fruit had ripened only slightly and was becoming mouldy, especially at the two higher temperatures, the mould starting generally on the side on which the fruit was resting. Seven days after removal from store, the fruit having meanwhile been kept at room air and temperature, all the fruits were badly moulded, though some of the 45° F. batch had ripened. It is concluded that with the present types of fruit and methods of storage papaws cannot be stored successfully.

206. SMITH, F. E. V.

634.3-2.4

Stem-end rot of citrus and its control in the packing house.

J. Jamaica Agr. Soc., 1932, 36 : 59-64.

The moist and heated atmospheric conditions of Jamaica are highly conducive to the rapid spread of stem-end rot fungi. The excessive damage caused recently by this disease in Jamaica resulted in a determined and successful attempt to discover adequate methods of control. It was recognized that control could best be obtained in the packing houses; accordingly experiments were made to test the effects of washing and drying processes and the effects of colouring with ethylene. It was found that when washing fruit, drops of water remained in the "button" long after the fruit was dried and polished, and that these moist conditions remained after

packing long enough to allow the fungus spores to develop. Rapid drying by warm air reduced infection to one half. The use of ethylene for artificial colouring was found (as also in Florida) definitely to increase the amount of infection. Ethylene, however, also often causes the buttons to fall out. The temperatures of the colouring rooms is ideal for the 100% germination of fungus spores. It was thought that if this high germination could be induced in the colouring room and the buttons subsequently removed with the growing spores on them, an effective control could be obtained. A trial proved so successful that the treatment has been extended to tree ripe fruits which do not ordinarily need colouring. The experiments were very thorough, involving 40,000 grapefruit and 30,000 oranges. In the final test with oranges, which had never previously shipped satisfactorily, infection was reduced in a shipment of 80 boxes from 18% in the uncoloured and 31% in the coloured to only 1% by the removal of the buttons after colouring. Briefly the treatment is: Apply two doses of ethylene (1-6,000) ventilating well between each dose. Keep the colouring room moist. After 36-48 hours gassing remove the buttons from the fruit; girls can be easily trained to do this with a small spoon without damaging the fruit. Dry the fruit thoroughly before packing. In the orchard remove all dead wood from the trees. The author states that a fuller and more scientific account of these experiments is to be published elsewhere.

207. RYGH, O., AND OTHERS. 577.16
Chemische Untersuchungen über das antiskorbutische Vitamin. I. and II.
Ueber Narkotin und dessen Abkömmlinge als Antiskorbutica. (**Chemical investigations on the antiscorbutic vitamin. I. and II. Narcotine and its derivatives as antiscorbutics.**)
Hoppe-Seyler's Zeitschrift für physiologische Chemie., 1932, 204: 105-11, bibl. 11, and 204: 114-22, bibl. 7.
and,
LALAND, P.
Versuche zur Isolierung des Narkotins aus verschiedenen Vegetabilien.
(**The isolation of narcotine from various plant materials.**)
ibidem, 204: 112-4, bibl. 1.

The authors found noteworthy amounts of the alkaloid narcotine in the juice of unripe orange and lemon fruits. It diminishes during ripening, giving place in the ripe fruit to the vitamin. Laland tested the occurrence of narcotine in various plant substances in an immature state—and found it in appreciable quantities in cabbage, tomatoes and potatoes. In milk also traces, although minute, were always present. Cranberries, known to be only minutely antiscorbutic, yielded no trace despite repeated trials.

NOTES ON REPORTS AND BOOKS.

208. EAST MALLING RESEARCH STATION. 634(072)(058)
Annual Report for 1931 (19th year) A.15, 1932, pp. 89.

Urgent economy has necessitated the merging of the two parts of this Station's report, which have hitherto been issued separately as I. General and II. Supplement, into one single number. This is composed of four sections, namely, I. The experimental farm. II. General review of research work. III. Preliminary research reports. IV. Bulletins for fruitgrowers. In section I notes are given on the particular farm operations and on grading and marketing different kinds of fruit, hard and soft. Crop records and returns are stated. It is noted that the apple plots grassed down in 1930 yielded fruit somewhat smaller but of greatly superior colour and finish to the cultivated plots. In section II brief notes of the work of the Pomology department are given (pp. 21-30), on the following: rootstocks for apples, pears, plums, cherries; root development in fruit trees; biennial bearing; double working; non-setting of pear blossom; pruning; fruit thinning of plums and apples; manuring of apples and plums; variety collections;

breeding of apple rootstocks immune to Woolly Aphis (*Eriosoma lanigerum*) and of dessert varieties to provide a succession of new varieties; Kent fruit soils survey; walnuts, their vegetative propagation—12% of trees worked in the open nursery have so far been successful—variety trials—64 varieties obtained—observations on established trees, oil determination, curing and storage methods; small fruit nomenclature and classification, establishment of clonal races, planting, training and pruning of small fruits, manuring of raspberries. Further brief reports are made by the following departments: Statistics and Records, p. 31; Physiology, 32-3; Biochemistry, 34-5; Plant pathology, Mycology and Bacteriology, 36-40; Entomology, 41-44; Hops, 45-6.

Section III (pp. 47-56) contains the following reports: Notes on certain plant diseases observed in 1931—Notes on insect pests for the year 1931—Weather conditions during 1931.

Section IV (pp. 57-84) contains the following articles: Some aspects of Morello cherry culture*—The pruning and renovation of apple trees*—The planting situation—Bacterial Canker of plum trees—Some fundamental considerations regarding successful control of apple scab—A simple method of forecasting insect attacks in orchards previous to the spraying season*—The control of the raspberry and loganberry beetle (*Byturus tomentosus*) by means of Derris.*

209. HUNTER, H.

63(03)

Encyclopaedia of Scientific Agriculture, 2 vols., Baillière, Tindall & Cox, London, 1931, pp. 1-676 and 677-1361, £3 3s.

To the horticulturist in England this work is likely to be of considerable reference value, but possibly of less value to his fellow Overseas in the Dominions and Colonies. Thus the section on deciduous fruit growing (pp. 441-96) is a short, concise account of modern practice in England in accordance with the findings of the English research stations, which will interest the English grower of fruit in particular and less directly growers in parts of the Dominions. Articles are given by T. Wallace on manuring and by F. R. Petherbridge on insect control, but the equally urgent problem of disease control in the orchard has not been treated so fully. W. F. Bewley deals with glasshouse crops (pp. 497-519) and gives useful information on such points as buildings, heating, soil sterilization, insect pests, and on the growing of tomatoes and cucumbers under glass. Hops (pp. 554-73) receive adequate attention, A. H. Burgess, E. S. Salmon and the late F. Theobald dealing with common practice, diseases and pests respectively. A special section is devoted to insecticides and fungicides (pp. 592-607), C. T. Gimmingham giving notes on the different groups of contact and stomach poisons, as also on soil fumigants and fungicides. In the section on market gardening (pp. 706-50) cultural hints and names of recommended varieties of the more commonly grown English vegetables are given. C. West and A. H. M. Smith are responsible for the story of refrigeration (pp. 1031-46). They deal at some length with the cool storage of apples, touching on the new possibilities offered, but as yet only little explored, by gas storage, while other fruits are dealt with more cursorily. Vegetable breeding (pp. 1227-34) and suggested lines of approach are discussed by D. Boyes. Virus diseases and some of their problems are outlined by J. Henderson Smith (pp. 1238-42).

But the tropical horticulturist, who is inspired with hope by the illuminating and concise 4 pages of information on bananas and may be no less pleased with a further erudite article by the same author, Dr. H. M. Leake, on cacao, will possibly be somewhat surprised to find that under the heading Citrus he is merely referred to Refrigeration, where about $\frac{3}{4}$ page is devoted to the question of storing that crop, and that, while rice, rubber and sisal are discussed at some length, such crops as coffee, coconuts and tea do not appear at all, and dates and avocados receive only a meagre reference under refrigeration.

Apart from the above it may be of prosaic interest to the horticulturist to know the other subjects of essentially horticultural interest, which are touched on briefly or otherwise in the work. They are: Fruit production in Australia, Canada, New Zealand, South Africa and the West Indies—Bulb growing (4 pp.)—Fertilizers (47 pp.)—Flax (22 pp.)—Ginger—Lavender (4 pp.)—Liquorice—Mushrooms (3 pp.)—Nuts, i.e. cobs, filberts and walnuts (4 pp.)—Peas (7 pp.)—

* Separate abstracts given in this number.

Pepper-Peppermint (2 pp.)—Potato (50 pp.)—Preservation, i.e. canning of fruit and vegetables (4 pp.).

In most cases the value of the section is much increased by the bibliographical references to authoritative publications on the subject concerned.

210. KEEBLE, SIR F.

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Fertilizers and food production on arable and grassland.

Oxford University Press, 1932, pp. 196, 5s.

The aim of this book is to show the large increase of home grown food that could be brought about by fertilizers used intelligently and therefore economically in the light of present scientific knowledge. Sir Frederick in the opening chapter traces step by step the decline of British agriculture from 1868 to the present day and uncomfortable reading it makes. He describes how the British farmer unable to compete with the new supplies of wheat and other foods produced abundantly and cheaply on the virgin soils of fast developing new countries and made easily accessible by the ever increasing speed of transport and communications, was caught in the vicious circle—"less wheat, fewer green crops and roots, less food for folded sheep (7 million sheep lost since 1868), an ever dwindling rural population, and less fertile soil." Full tribute is paid to the gallant fight put up by the farmer in this battle against circumstance, and the illusion that the farmers of Great Britain are in any way inferior in skill or energy to their competitors abroad is dispelled by fact and figure. In spite of all, however, the future is not dark. Provided that the farmer can be secured by the nation a fair price for his products, there is no doubt but that modern agricultural science can so increase the productivity of his lands that prosperity will certainly be his once more. The almost startling increase of yield through the use of suitable fertilizers at suitable times on cereal and market garden crops forms the subject of succeeding chapters and the author then concentrates on methods for the amelioration of grassland, our greatest asset for food production. By the application of nitrogen to the right kind of grassland in early spring (February or March), an early flush of grass is obtained which is ready for grazing from 14-28 days earlier than in the natural state, nor does this forcing harm the pastures; on the contrary it improves them. These results have been borne out by experiments carried out all over the Empire under the auspices of the Jealott's Hill staff. Chapters on rotation of crops, soil fertility, and the scientific use of fertilizers bring one regretfully to the end of a most stimulating book. It is natural in a journal devoted largely to reporting the results of research in connection with fruit to see whether the lessons taught in this book can be fittingly applied to the orchard. Can, for instance, an early dressing of nitrogen resolve the problem of biennial bearing and eliminate the profit-stealing off year? The author, without discussing the question in detail, says that it can. Bearing in mind that nitrogen is a substance that is here today but gone tomorrow the exact time of application becomes a matter of importance on which definite information is much to be desired. The grass needs warmth and nourishment to start it into growth and should the warmth be there but the nourishment lacking, growth is retarded. Intensive observation of fruit tree roots has shown that they are active at a very early date. When, therefore, should the nitrogen be applied? American workers agree that under their conditions, given a district with a spring rainfall, the spring is a suitable time, though some favour an autumn application as well. (In districts with a dry summer a spring application fails to reach the roots in time to be of benefit.) But just at what period of the tree's spring growth? This, the vital point, is still a subject for discussion. Manaresi working with pears and peaches found that an application of nitrate of soda 16 days before flowering noticeably increased the nitrogen content of the flowers, young fruit and leaves, doubling the percentage set of flowers and so the subsequent yield, and indeed a fortnight before full blossom is now generally regarded as the time of application from which the fullest benefits can be reaped. But is this to be considered final? Would still earlier applications be even more productive? These lines are being thought about by workers and this book by Sir Frederick Keeble, even though it touches but lightly on the subject of fruit, cannot fail to do other than inspire those who are devoting their energies to studies in this field.